The Tool Engineer

GLOBE CORP.—WARBIRDS IN MINIATURE . . . P. 51

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

APRIL, 1951
VOLUME XXVI, NO. 4

PLANNING
ENGINEERING OF TOOLING
CONTROL EQUIPMENT
PRODUCTION

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Defense production calls for *precision*—and precision points directly to PRATT & WHITNEY.

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Right now our huge, completely equipped plant is well primed for *any* emergency. Our experienced engineers and craftsmen are thoroughly trained in the P&W tradition for precision. Know-how, skill and accuracy are reflected in all the equipment they build—P&W *Precision* Machine Tools, Cutting Tools and Gages.

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- Jig Borers
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- Dies (all types)
- Milling Cutters
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- Precision Screw Plates
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- Tri-Roll Thread Comparators
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- Special Gages

PRATT & WHITNEY
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Symbol of Accuracy
SINCE 1860

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RIL, 1951

The Tool Engineer

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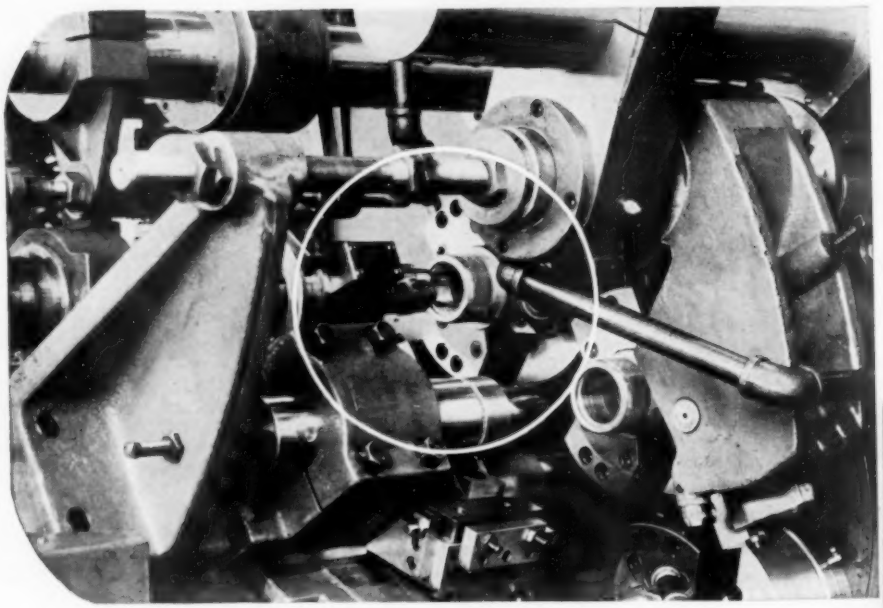
AMERICAN SOCIETY OF TOOL ENGINEERS

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second-class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription for members, $2.00. Non-members, $6.00. Canada, $6.50; all other countries, $8.00 per year.

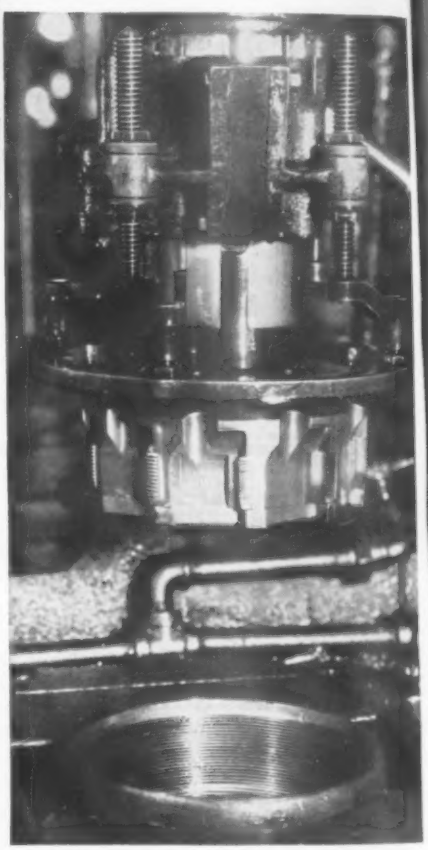
OFFICE OF PUBLICATION: 239 E. Chicago St., Milwaukee, Wis.
EXECUTIVE AND EDITORIAL OFFICES: 10700 Puritan Ave., Detroit 21, Michigan.

MANY THREAD DIAMETERS
WITH ONE LANDIS TAP



Detachable Heads Cut Wide Range of Internal Threads

The LANDIS Collapsible Tap is a many-purpose tool—yet a single-purpose tool. The versatility of the LANDIS Tap enables it to handle a wide variety of jobs—yet it handles each job as though it were a specially-designed tool.



WIDE THREAD CAPACITY

The ability to cut thread diameters of varying sizes is an outstanding feature of all LANDIS Taps. The thread-cutting head is detachable and tap heads of various sizes and capacities can be used interchangeably on the same tap body. This design makes it possible to cut an unusually-wide range of internal thread sizes with a minimum tool investment. For instance, the 5ALT Tap will cut threads from 1 5/8" to 6 5/8" in diameter.

EASY REMOVAL FROM WORK

LANDIS Taps are constructed with a built-in **collapsing** action. Chasers drop free from the work into the tap head at the completion of the thread. The tap can be removed directly without "backing out," thus saving labor time and chaser wear, and reducing the number of torn threads.

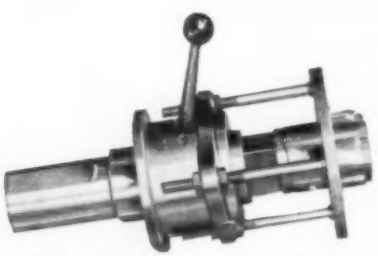
INTERNAL TAPERED THREADS

LANDIS Taps are of two types—the ALT for parallel threads—and the LL for tapered threads. The LL Receding Chaser Collapsible Tap is especially designed to cut API Standard threads in any machineable material well within all required tolerances. This tap features a new receding action—a fulcrumed lever—which gives a positive receding movement to the chasers and allows precision thread tapers. The low cutting strains thus obtained lengthen chaser life and improve thread accuracy and finish.

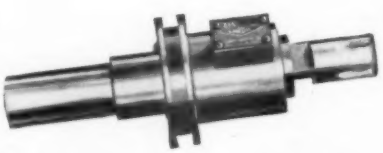
GENERAL FEATURES

LANDIS Taps can be used as stationary or rotary taps, and can be quickly converted from one type to the other. Left-hand threads may be cut with the same tap bodies, using left-hand tap heads. All taps have a fine size adjustment which allows compensation for wear and regrinding, and the style LL Tap can be adjusted to compensate for slight errors in taper.

Consider the money-saving features of LANDIS Taps in cutting internal threads in your plant. Write for Bulletins G-94 and G-95.



ALT Collapsible Tap arranged for use as a Stationary Tap.

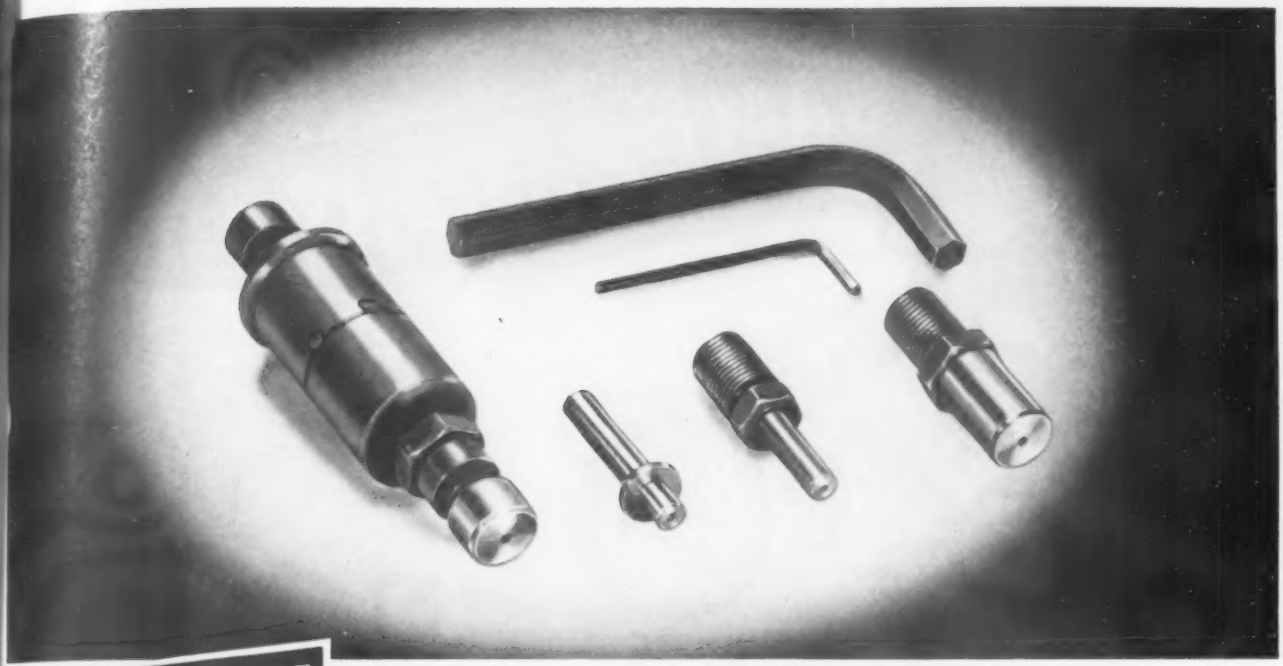


LL Receding Chaser Collapsible Tap arranged for use as a Rotary Tap.

LANDIS MACHINE COMPANY

WAYNESBORO • PENNSYLVANIA

THREADING MACHINERY—THREAD CUTTING DIE HEADS—COLLAPSIBLE TAPS



HARDINGE
ELMIRA, N.Y.

UNIVERSAL COLLET STOP SET

For Your Second Operation Chucking Work

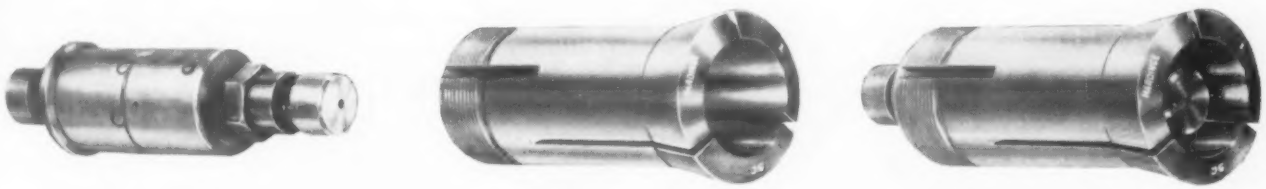
. . . Converts standard 1" capacity 5C Hardinge Collets into solid stop or spring ejector stop collets *without alteration* of the standard collets. Also fits other 1" capacity lathe collets, regardless of the collet length.

Application does not require machining of the collet. The stop is merely placed in the collet.

With the Hardinge Universal Collet Stop Set, it is easy to chuck parts to a predetermined depth in the collet for completing second operations. The set provides either a solid stop or spring ejector stop for small or large diameter work. Each insert is adjustable to suit varying requirements. Once that is done, you merely apply the complete collet stop and tighten a lock screw to securely anchor it inside the collet.

•

The use of a Hardinge Universal Collet Stop eliminates your buying special step collets or applying permanent stops. You save time and money. Write and ask for bulletin CS giving further details and price.



UNIVERSAL COLLET STOP + STANDARD COLLET — SPECIAL STOP COLLET

HARDINGE BROTHERS, INC., ELMIRA, N. Y.
"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

How many lives is a dollar worth?

The cost of a machine, fixture or broach is no gage of how well they will work together and produce together in any broaching installation—and in no process is proper relationship of tools, fixtures, and machines more vital than in broaching.

The wrong broach, fixture or machine always costs MORE.

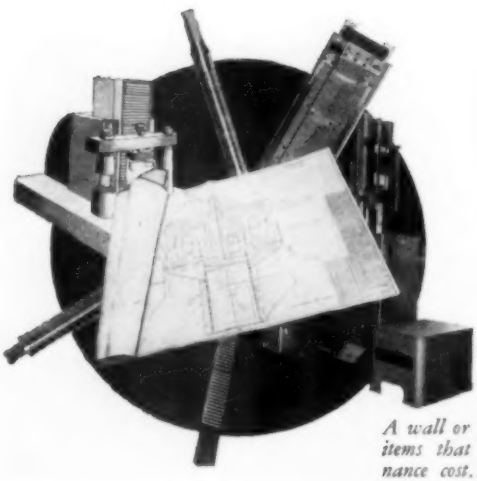
That cost, today, is measured not only in waste of time and money but potentially also *in American lives.*

The time is now. The place—wherever broaching is being adopted to produce more goods—faster . . . with the minimum of precious manpower . . . with the minimum of shut-downs.

To do that, broaching equipment—machine, fixtures, broaches—must be designed, integrated and built to do the job "right the first time."

That's why Colonial is ready and willing to check over your broaching layouts and recommend such changes as appear desirable on the basis of its vast experience with practically every conceivable type of broaching installation.

It costs you nothing. Have Colonial's specialists check broaching equipment or tooling before you release that order.



PIONEERS OF H.S.S. BROACHING

COLONIAL

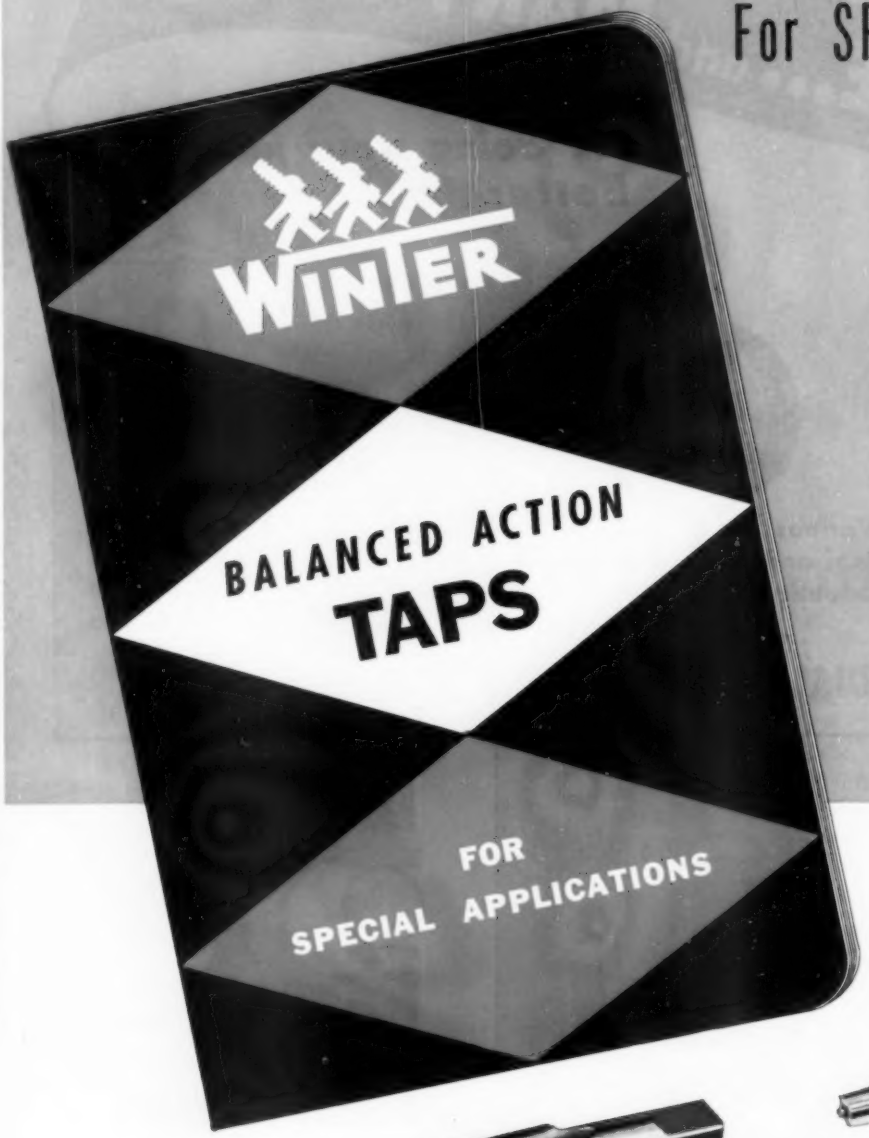
BROACH CO. DETROIT 13

FOR YOUR TOOL ROOM

A wall or bulletin board poster of DO and DON'T items that should help you reduce broach maintenance cost. No charge. Ask for BN-1250.

WINTER "BALANCED ACTION" TAPS

For SPECIAL APPLICATIONS



If you do tapping in plastics, aluminum, cast iron, brass, or any other special applications, you will be interested in this new 20-page booklet. It describes the various kinds of Winter Taps designed for unusual types of work, giving the recommended tapping speeds and tapping lubricants for various materials. A free copy may be obtained from your Winter distributor. In addition to taps for special applications, Winter makes a complete line of standard taps, including chip driver, hand, machine screw, pipe, pulley, nut, and tapper taps.

WINTER

ALWAYS AT YOUR SERVICE

YOUR LOCAL DISTRIBUTOR carries a complete stock of WINTER Taps on his shelves—as close to your tapping problems as the telephone on your desk.

WINTER BROTHERS COMPANY • Division of the National Twist Drill and Tool Company, Rochester Michigan, U.S.A. • Distributors in Principal Cities • Branches in New York, Detroit, Chicago, San Francisco

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The NATIONAL Service Engineer

Have you a special problem in drilling, milling, hobbing, or other operations involving the use of rotary metal cutting tools? If so, you'll find the National Service Engineer a real friend in need. He will put at your disposal all his specialized training and day-to-day experience in helping users make tools last longer and do better, faster work. No charge or obligation, of course. To contact him call your distributor.

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It is NATIONAL'S firm belief, based on long experience, that the local industrial distributor is the one best source for all staple industrial needs — including NATIONAL Metal Cutting Tools.

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National

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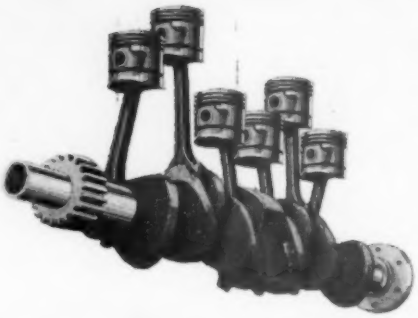
PISTON PRODUCTION



UP 21%

New Heald Bore-Matic bores and grooves automotive pistons *three at a time*

When it comes to high speed precision production, the automotive industry has consistently set the pace. Perhaps that's because so many automotive manufacturers bring their precision finishing problems to Heald.

The installation shown below is a typical example. This new Model 322 Bore-Matic boosted piston production 21% over previous methods. The pistons are bored and grooved three at a time in a single, high-speed, automatic cycle. All the operator has to do is load the parts, throw the starting lever, and remove the finished pistons. Even the loading and unloading has been speeded up by a three-station, hydraulic clamping and locating fixture.

Remember—when it comes to precision finishing, it pays to come to Heald.

HEALD

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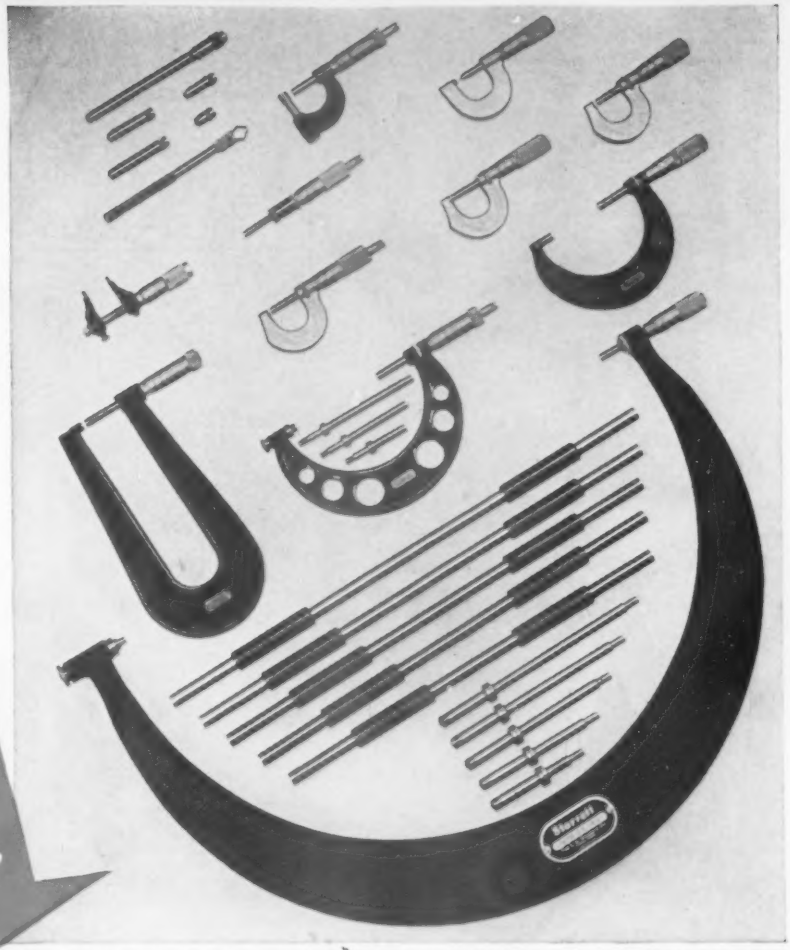
Indianapolis • Lansing • New York

12 BIG REASONS WHY

YOUR BEST BUY is Starrett Satin Chrome MICROMETERS



ALSO AVAILABLE WITH TUNGSTEN CARBIDE MEASURING FACES
For Unusual Applications Where Severe Abrasive Conditions Exist

SATIN CHROME FINISH. Pioneered by Starrett. Now on thimble and sleeve of all micrometers — on the frame of all full finish models. Non-reflecting, eliminates glare, markings stand out sharp and clear, resists rust and stains, increases speed and accuracy.

TAPERED FRAME. Easier to measure in narrow slots and tight places, Standard on all full finish outside micrometers.

HI-MICRO FINISH on contact faces of anvils and spindles for more accurate measurements. This mirror-like finish insures better parallelism of contacts with longer life and less wear.

HARDENED THREADS. Micrometer screw hardened, stabilized and threads ground from the solid for lasting accuracy.

ONE PIECE SPINDLE. Insures long, accurate life.

QUICK READING FIGURES. Every graduation on the thimble numbered for quick, error-proof reading.

DECIMAL EQUIVALENTS of 8ths, 16ths, 32nds and 64ths conveniently marked on frame or thimble.

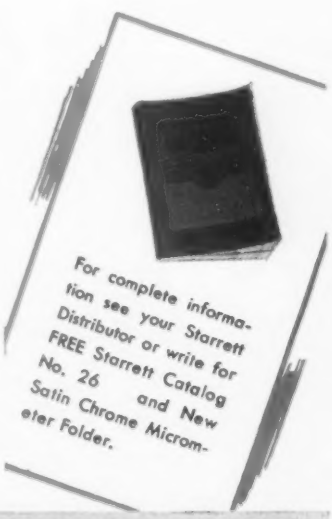
SLEEVE ADJUSTMENT. Simple adjustment of sleeve maintains Starrett accuracy at all times.

FRICTION THIMBLE. Friction stop mechanism in the thimble "right under your thumb" available if desired. Also available with ratchet stop at end of thimble.

PRECISION BUILT by the World's Greatest Toolmakers.

TYPES FOR EVERY NEED. Sizes from 1" to 168" — all types including tubular frame, black frame, stainless steel, ball anvil, screw thread, crankshaft, sheet metal, tube and paper gage micrometers. Also micrometer heads, inside micrometers and inside micrometer calipers.

EASY TO BUY. Available through Starrett distributors everywhere. The world's leading line of precision micrometers.



For complete information see your Starrett Distributor or write for FREE Starrett Catalog No. 26 and New Satin Chrome Micrometer Folder.

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Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.

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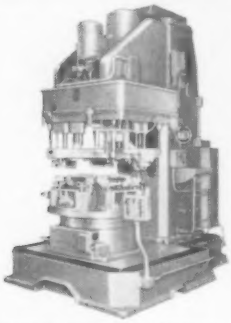
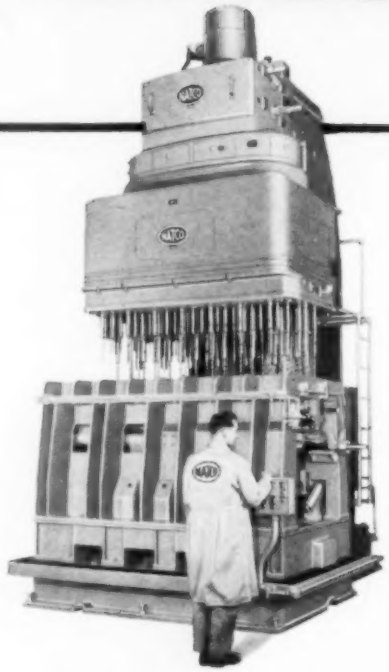
50 Years Experience

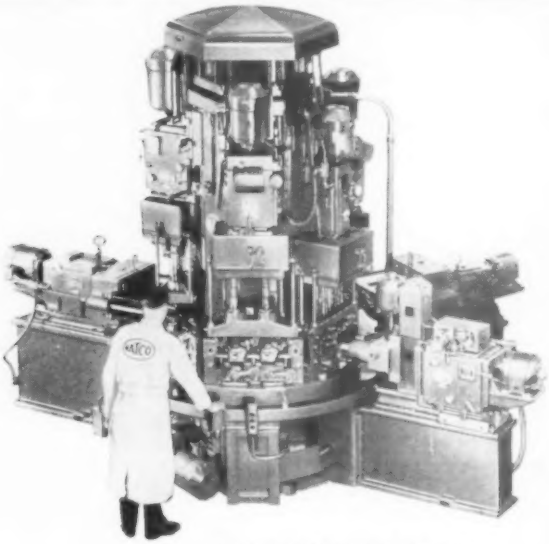
NATCO LIGHT SENSITIVE
DRILLER AND TAPPER



NATCO HOLESTEEL ADJUSTABLE
DRILLER AND TAPPER



NATCO HEAVY DUTY HOLESTEEL DRILLER

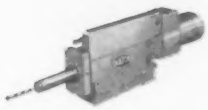


NATCO STATION TYPE MACHINE

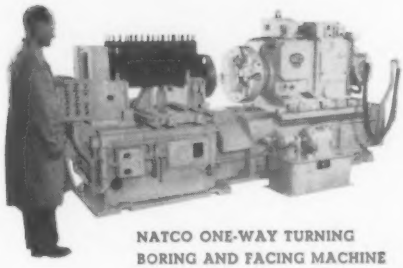
Out of the past fifty years of NATCO experience has come a deeper understanding of today's engineering and production problems. By reason of this maturity of understanding the NATCO organization is better equipped to help you solve your drilling, boring, tapping and facing problems. Better equipped with experienced engineers and designers. Better equipped with the most complete range of adjustable and fixed center multi-spindle machines in the world.

A few of the various NATCO machines are illustrated above. As you can see they range from small, fast, light-sensitive multi-drillers and tappers to large automatic processing machines . . . from single spindle to an unlimited number of spindles, from one direction to any number of directions, vertical, horizontal or angular, special or standard and operations range from 1/16" drill to 14" or larger bore. The materials worked include iron, steel, bronze, aluminum, wood and plastic.

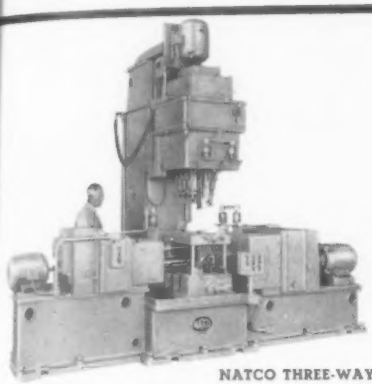
NATCO HIGH SPEED SENSITIVE DRILLER AND TAPPER



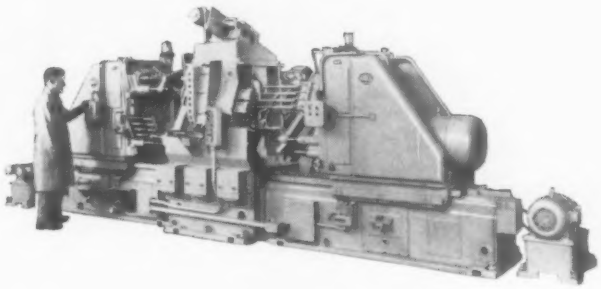
NATCO HIGH SPEED SENSITIVE UNIT



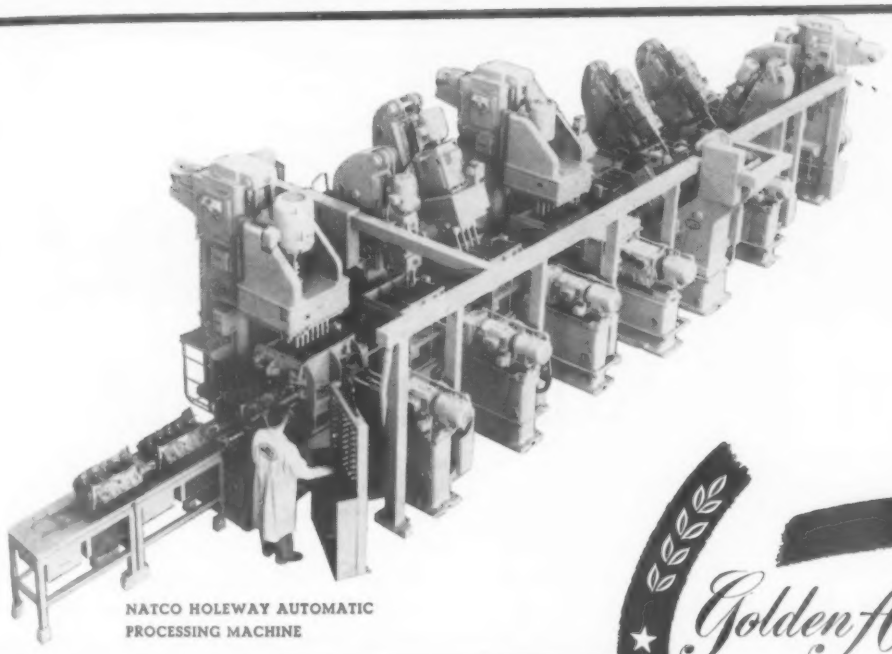
NATCO ONE-WAY TURNING BORING AND FACING MACHINE



NATCO THREE-WAY TAPPER WITH INDIVIDUAL LEAD SCREW



NATCO THREE-WAY TRUNNION TYPE DRILLING MACHINE



NATCO HOLEWAY AUTOMATIC PROCESSING MACHINE

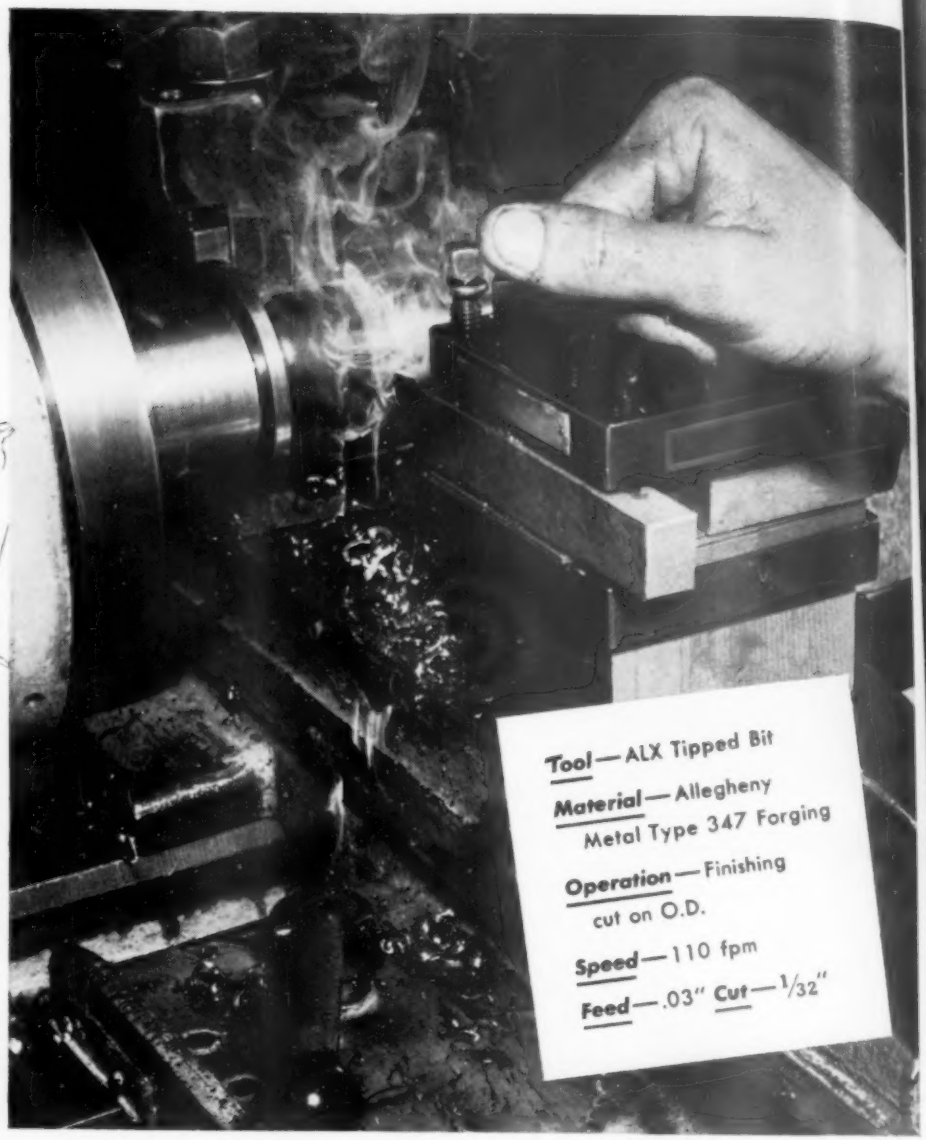
Golden Anniversary

1901 NATCO 1951

Today NATCO offers you not only fifty years experience and ample production facilities but also several branch offices conveniently located to serve you in Detroit, Chicago, Buffalo and New York City.

To solve your problems in drilling, boring, facing and tapping most economically . . . Call a NATCO Field Engineer Today!

Want Faster Cutting? Fewer Grinds?



. . . then get ALX ALLOY Cutting Tools

Write for copy of

"ALX ALLOY TOOL BITS"

An eight-page booklet tells how you can effect production economies by using ALX for fast turning, boring, and facing—in certain applications. Helpful information includes grinding, tool angles, speeds and feeds, brazing of tips. *Write for your copy.*

ADDRESS DEPT. TE-16

Many a machine shop—and probably yours—has jobs on which ALX Tipped Tools or ALX Solid Bits step up production by permitting increased speeds, feeds, and depths of cut. Resharpening is less frequent, the reason being special composition.

ALX is a cast-to-shape, non-ferrous, cobalt-base alloy containing chromium, tungsten, carbon, and boron. The as-cast hardness of 60-62 Rockwell C obviates later heat treatment. Tools stay sharp at accelerated speeds and higher temperatures. Speed range is above that of high-speed steel, but lower than with carbide. At such intermediate speeds, the superior performance of ALX results from toughness, red-hardness, edge-strength, and abrasion-resistance values combined.

An Allegheny Ludlum tool engineer can quickly point out the strategic spots to tool up with ALX. For this service, call A-L. ● *Allegheny Ludlum Steel Corporation, Forging and Casting Division, Detroit, 20, Michigan.*

For complete MODERN Tooling, call

Allegheny Ludlum

WAD 3485

AL
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SINCE 1854

"better try a Michigan"

The basic principle behind the design and manufacture of Michigan gear tools—hobs, shaper cutters, shaving cutters—is to produce tools capable of giving you MORE GOOD gears and FEWER BAD ones.

An important reason why Michigan gear tools do both is that Michigan Tool Company has the know-how covering ALL phases of gear production—from blank to finished gear.

There is a Michigan Tool field engineer right in your area—ready to help your gear production department.

MICHIGAN TOOL Company

from blank to finished gear

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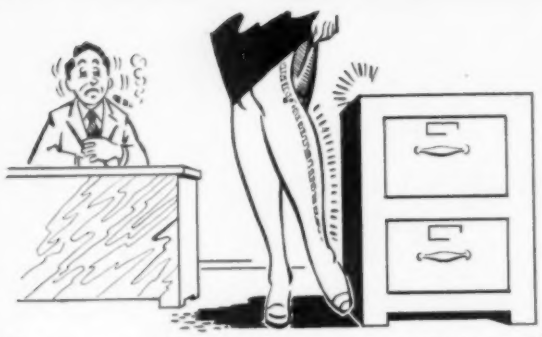
of the MORSE "Hi-Helix" Design ... that Really Cuts Your End-Milling Costs!

CHIPS CAN'T CLOG THE FLUTES of Morse End Mills made to this exclusive design. For the shear-cutting action clears the chips in a smooth, even flow. Cutting is far faster . . . tool-life far longer. And to get even longer tool-life, specify Morse Electrolized End Mills.

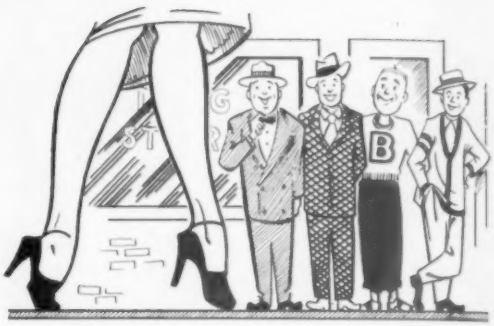
Morse Hi-Helix End Mills are precision-made . . . with 2 flutes for hogging . . . 4 or more for finishing. *See your Morse-Franchised Distributor.* He's the only one who can give you Morse-Quality for *every* type of end-milling job. He has the experience . . . and a complete Morse stock . . . to serve you promptly and well at all times.

Morse Twist Drill & Machine Co., New Bedford, Mass., *(Div. of Van Norman Co.)*
Warehouses in New York, Chicago, Detroit, San Francisco

MORSE
Cutting Tools

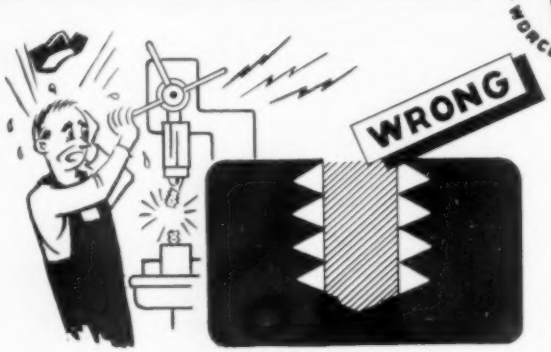


The way some gals stretch their hose is most shocking.
One tap — the threads weaken and ruin the stocking.

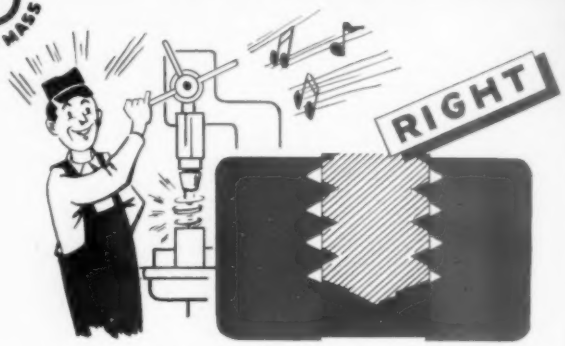


But just the right load cuts the strain to a trifle —
The threads'll be strong and we'll ALL get an eye-full!

JOHN BATH CO. INC. · WORCESTER · MASS.



Like tapping one hundred per cent full thread —
Much strain — no gain — the tap breaks instead!



If you'll tap to a normal seventy-five,
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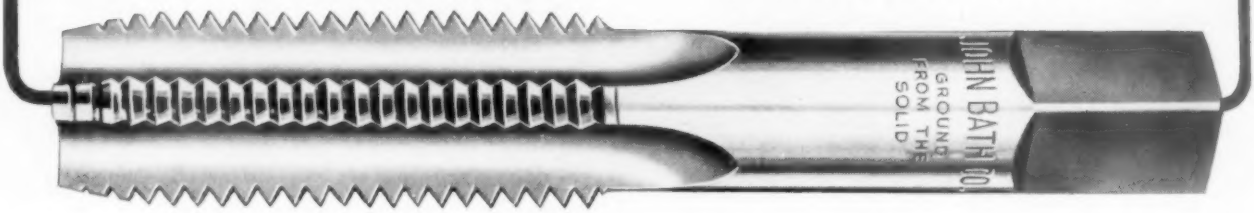

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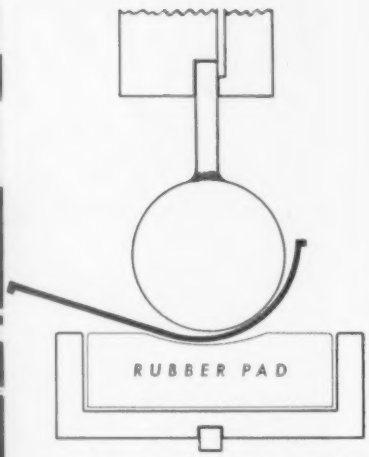

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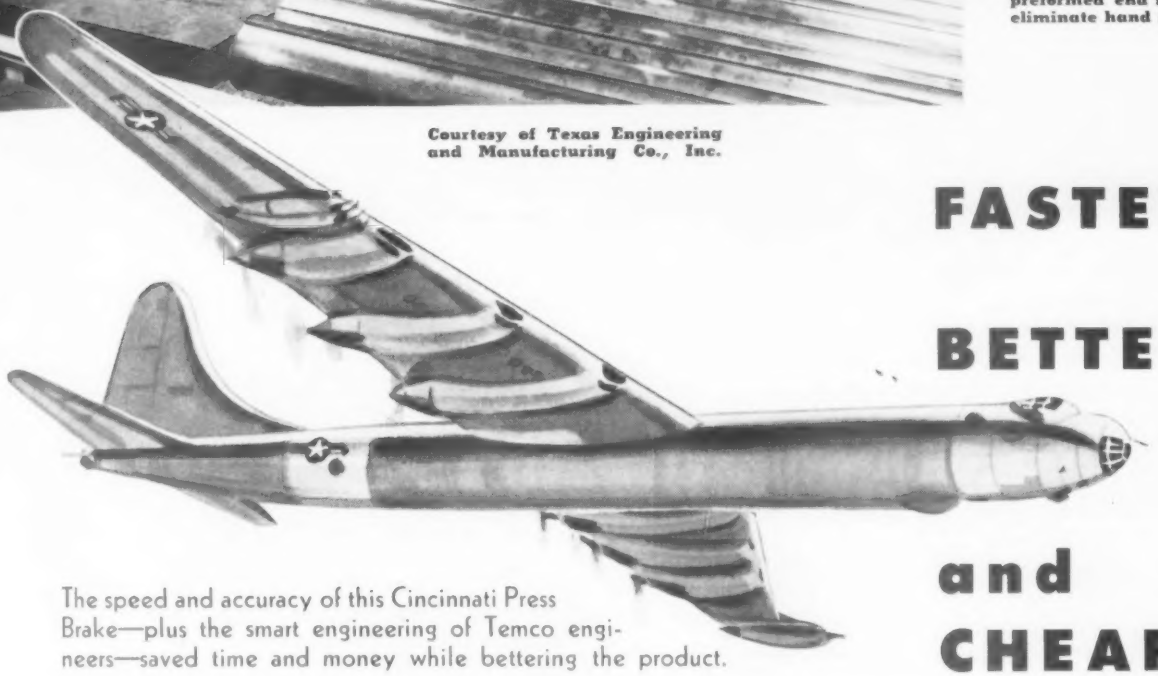

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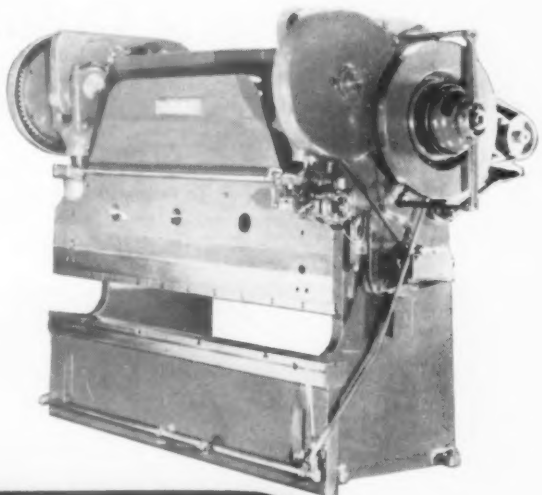

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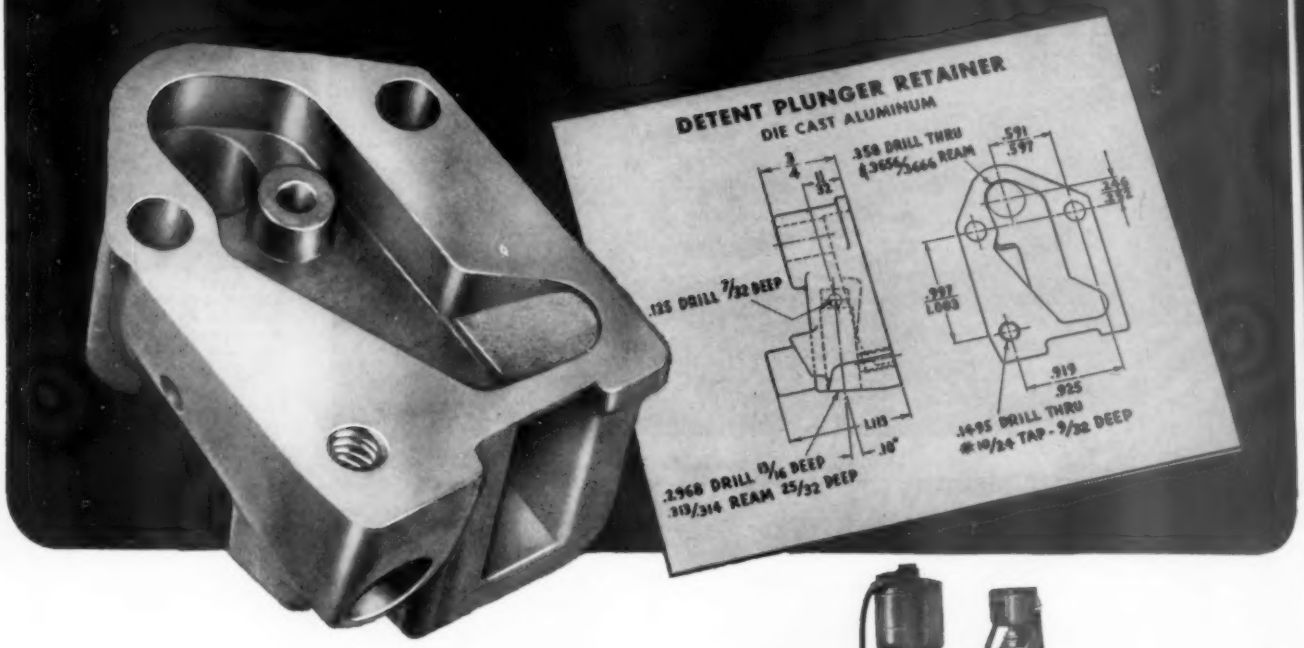

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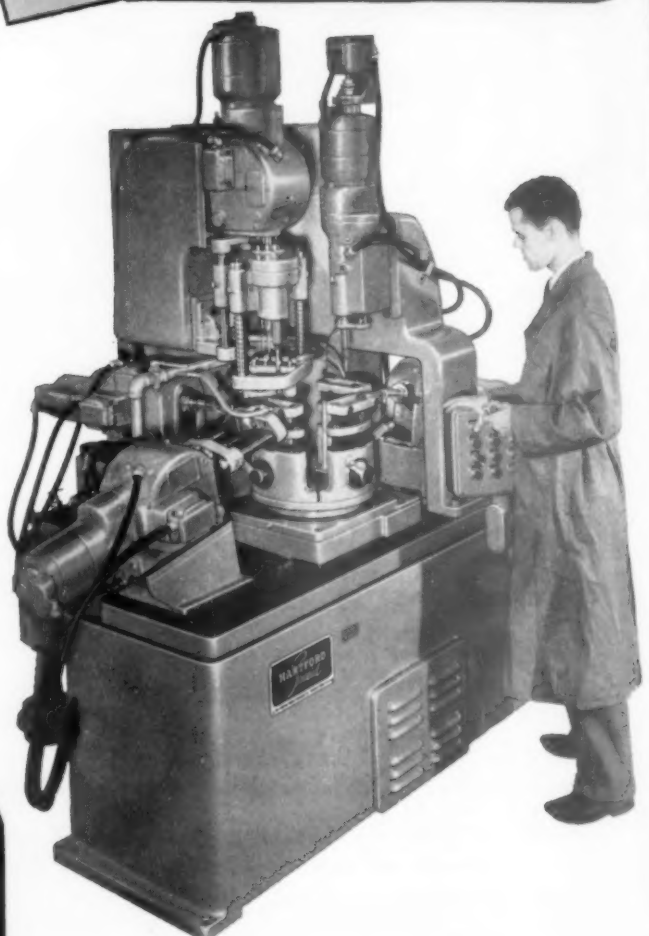

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THE TOOL ENGINEER
Publication of The American Society of Tool Engineers

The **Tool Engineer**

a Letter from the Editor...

Recently ASTE made a survey of its membership to determine the extent of continuous modernization programs among manufacturing companies in various industries today. The survey represented a significant segment of ASTE's membership, and the conclusions resulting from it are very interesting.

Tool engineers are fundamentally a basic part of mass production industries, and this point was substantially clear from this study.

One of the purposes of the survey was to determine the responsibilities of tool engineers in their professional capacities with regard to the initiation of the purchase of new equipment, and their responsibilities in selecting the type and make of equipment to be purchased.

By tool engineers in their professional capacities ASTE refers to those ASTE members who are titled as tool engineers with their companies, or who perform tool engineering functions. This does not, of course, include those many ASTE members who are a part of management.

Among those plants which have one thousand or more employees, some sixty percent have a continuous, planned program of modernization of equipment, plant facilities and processes. About forty percent of those companies with less than one thousand employees have some such program.

The automotive industry, which sponsored early the professional function of tool engineering, designates the tool engineer the responsibility of selecting the type and make of equipment in sixty percent of the industry. In forty-five percent of the cases, the tool engineer is responsible for initiating the purchase of new equipment.

In the appliance industry, the tool engineer is responsible in seventy-five percent of the cases for initiation of the purchase of new equipment. Sixty percent of the time he selects the type and make of new equipment to be purchased.

The electrical industry is even higher in its dependence on tool engineering. In almost a straight 100 percent, tool engineers select the type and make of equipment. Fifty percent of the cases rely on the tool engineer for initiation of the plan to purchase.

The agricultural industry, somewhat a newcomer to mass production methods, has already reached a high level of tool engineering practice. In about fifty percent of the cases, the tool engineer is responsible for both initiation of the purchase and selection of the type and make of equipment to be purchased.

This survey is important in many respects. Probably most important is the fact that, throughout the survey, those industries considered to be the most highly developed in mass production principles are the industries which rely most extensively on tool engineering principles and on tool engineers to head their equipment purchases and modernization plans. It forms a significant picture of the importance of tool engineering in industry today.

Gilbert P. Muir

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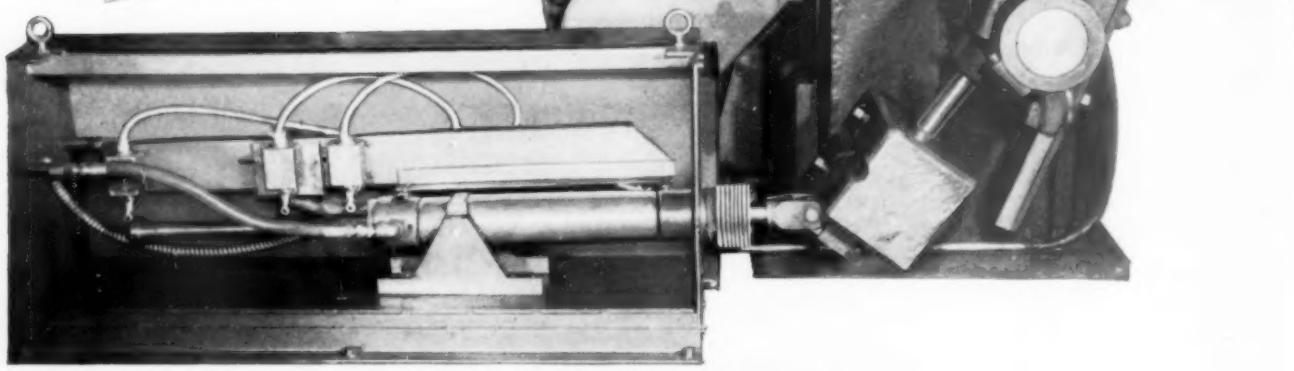

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The Tool Engineer

Editorial

Our Double Function

THAT THE TOOL ENGINEER must serve a double function in today's world was effectively brought out during our recent Annual Meeting in New York City.

This double function consists of two gigantic jobs: one the building up at an increasingly fast rate of our armament facilities, and the other the maintaining as far as possible the great flow of consumer goods that our economy demands.

Of course these two jobs are to a certain extent inconsistent by their very nature. Production of arms must take precedence over civilian production in choice of men, materials and plant facilities. But at the same time we are not yet engaged in total war; therefore we cannot stop the flow of the many living necessities which our totalitarian neighbors would dismiss as inconsequential.

The size of the job, when viewed logically, is tremendous. We have a certain productive capacity represented by available manpower, materials and machines. This capacity has been utilized fully during the half-decade since World War II in turning out the highest peacetime production volume in our history. Therefore it sounds impossible that any substantial part of this peacetime production could be maintained while simultaneously building up a full-sized war machine with mostly the same facilities. So thought the nation's experts and economists when their dire predictions of shortages made headlines across the nation.

But they reckoned without the tool engineer, as they did before World War II and again after the war. Better automobiles, commodities and farm equipment are still being turned out in tremendous quantities—perhaps not at the highest rates of 1950, but still at a rate better than most peace-time years. Materials shortages in other intances have presented a barrier that has been more serious, but here again the Tool Engineer is changing methods and procedures to utilize available materials other than those used for direct war production.

Tool Engineers in the months ahead face greater problems as materials become tighter, and war production accelerates at a faster rate. Numerically, we are spread fairly thin for the job ahead. But we are aware of the size of the job, and WE WILL DO IT.

J. J. Demuth

PRESIDENT
1951-1952

Measuring and Interpreting the Factors in Tapping Torques

By Allen J. Carruthers

RESEARCH ENGINEER
GREENFIELD TAP AND DIE CORPORATION

Part I

THERE IS A DEFINITE relationship between the efficiency of a tap and the twisting effort required to turn it. The amount of this effort depends upon many variable factors, some of which are tap design, tapping speed, the material being tapped, lubricants, and the mechanical operating conditions.

In order to improve the design of taps and to provide users with specific information on the most efficient tapping methods, a means of measuring the individual effects of those effort-consuming factors is needed. This may be achieved by the application of a suitable dynamometer to measure and, preferably, record the net forces developed in tapping under any known set of controllable conditions.

Dynamometer Design

Unquestionably, in the past, most tapping dynamometers have followed a general pattern or design, differing only in construction details and incorporating either indicating or recording mechanisms to register the tapping torque. Until fairly recently such dynamometers were mechanical machines which derived their measurement of tapping torque by overcoming the resistance of a suitable calibrated spring affected by a torque arm. Such a dynamometer was used by Messrs. Daasch and Hug* and is worthy of some discussion.

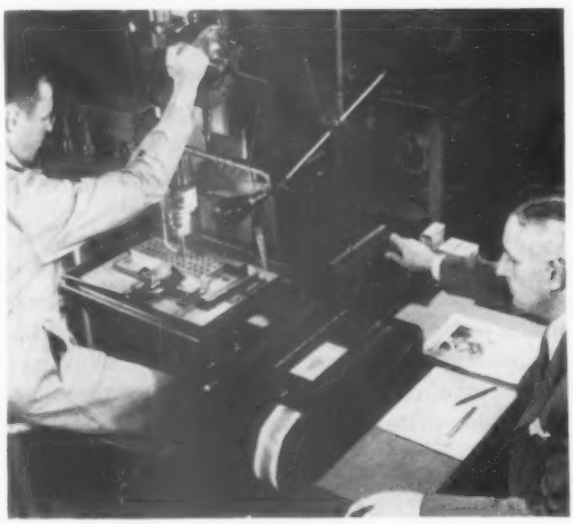
*Daasch, H. L., and Hug, J., "A Study of Torque and Influencing Factors as Related to Commercial Tapping of Metals." Iowa Engineering Experiment Station, Iowa State College, November, 1935.

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

Their dynamometer consisted essentially of a frame, turntable, torque arm, and recording device. The dynamometer was rigidly mounted on a drill press table and each test plate or bar was clamped to the dynamometer turntable. This turntable, mounted on two "Radax" bearings, was free to rotate except for the torque arm extending to the side. The torque arm was connected through a ball-and-socket joint to the recording device, an ordinary steam engine indicator.

Forces at the end of the dynamometer torque arm were transmitted to the opposed by an indicator spring. Springs of various sizes were available to provide a complete coverage of the torque ranges encountered. The springs were calibrated by clamp-

Fig. 1. The dynamometer set-up used in the tests to measure and record torques developed in tapping operations.



ing a long bar to the turntable of the dynamometer; at a fixed distance on the bar was fastened a cord which ran over a suitable ball-bearing-mounted pulley to a weight. Readings were recorded on the indicator cards, thereby giving the necessary calibration constants.

During the actual tapping, the indicator drum was turned in synchronism with the tap advance or tap withdrawal by means of a cord which passed from the drum over pulleys to a point on the drill press spindle rack.

Electronic Dynamometer

The need for an accurate, reasonably inexpensive, and instantaneous method of measuring tapping torque has been apparent for many years. Accordingly the Greenfield Tap and Die Corporation, about three years ago, instituted a research project to develop a suitable tapping dynamometer.

In collaboration with Ruge-DeForest, Inc., consulting engineers, and consultants to The Baldwin Locomotive Works, an electronic tapping dynamometer was developed which successfully measures and records the torque developed in tapping under any known set of controllable conditions. This dynamometer or tapping "torque-meter", as it is commonly called, employs bonded-wire electric strain gages to measure the strains directly at the tool.

The tapping torque-meter to be described consists of a taper-shank torque pick-up, a control box and a Brush oscillograph and amplifier. The complete dynamometer, in operation, is shown in Fig. 1. Fig. 2 illustrates the torque pick-up section which is assembled in the spindle of a drill press or tapping machine by means of its tapered shank.

During a tapping operation, the twisting effort imposed upon the tap is imparted to four torque-sensitive axial beams shown at *A*. To each of the beams are bonded special Baldwin SR-4 electric strain gages connected into a bridge circuit, the unbalance of which becomes a precise measure of stress change. A non-rotating Brush assembly *B*, supported over the spindle extension socket by ball bearings, contacts silver slip rings on the shaft, providing connections for applying voltage to the bridge and for measuring the unbalance signal, which is exactly proportional to the applied torque.

Measurement Range

A transformer in the control box supplies voltage to the pick-up bridge and also to a second internal bridge which can be unbalanced to provide zero setting and calibration signals. A range switch selects the whole or precise fractions of one-third or two-thirds of the pick-up bridge output to add to the internal bridge output and deliver to the amplifier. Phasing controls are also provided.

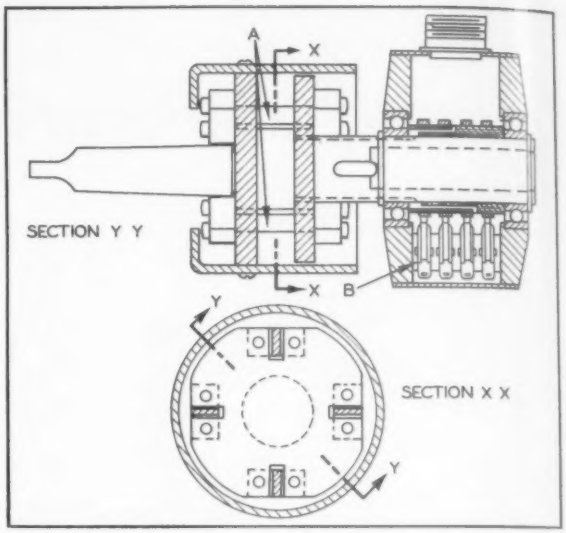


Fig. 2. Diagram of tapping torque pick-up section of torque-meter. Strain gages, bonded to torque-sensitive axial beams (A), transmit strain to Wheatstone bridge circuit.

To accommodate various tapping conditions, the torque pick-up sections have been made to handle three different ranges of torque. One measures torque in increments of 0 to 50, 0 to 100, and 0 to 150 in.-lb; another pick-up has a range of 0 to 450 in.-lb measuring torque in increments of 0 to 150, 0 to 300, and 0 to 450 in.-lb; while a third measures torque from 0 to 500, 0 to 1000, and 0 to 1500 in.-lb. Variations in torque, as reflected by the amplified signals of the bridge circuit, are transmitted to a pen motor in the oscillograph.

Fig. 3 illustrates the torque pick-up assembly. A floating type tap holder, which insures lateral tap alignment, thereby facilitating the test, can be seen at *A*. An adjustable clutch that prevents overloading of the torque pick-up is shown at *B*. The torque pick-up section, including the strain gage housing, as well as the Brush assembly housing and electrical connections to the control box and oscillograph is indicated at *C*. To insure a true reading, the circuit is calibrated before and after each measurement. In this way, any differences which occur in the torque reading are known to be due to variations in the circuit and not in the tapping setup. The original calibration of the torque-meter and all periodic re-calibration checks are accomplished through the application of a calibrating device, which consists of a graduated precision moment arm and accurate dead weights for each of the individual torque ranges.

The accuracy of the torque measurements obtained with this dynamometer is such that errors are no greater than plus or minus one percent. Similarly, the sensitivity of the instrument is such that even the torque due to the inertia of spindle reversal is registered in these readings.

In a study of this kind one must consider the fact that a tap is truly a complex tool which must pro-

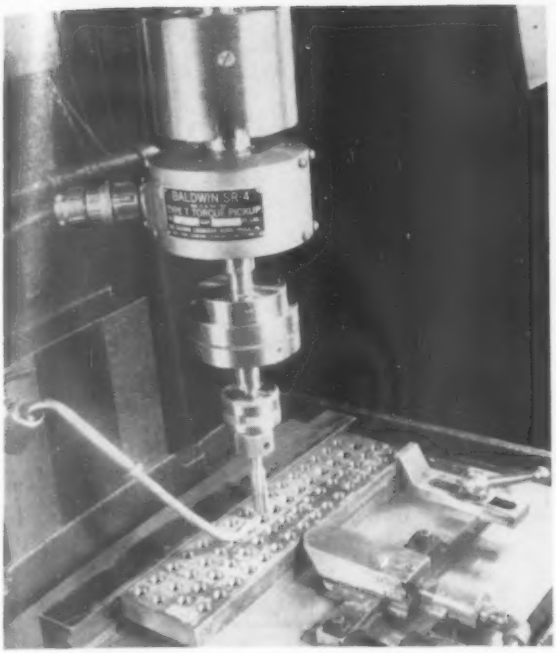


Fig. 3. The torque pick-up assembly in operation. Circuit is calibrated before and after each measurement.

duce a desired thread form, generally to close tolerances and in a single cut, within a confined area and at high speeds. Again, it must be recognized that there are many factors influencing the tapping torque and its measurement. While some of these are very obvious, others which may be considered as insignificant also may have very decided effects on the tapping torque and the resulting contour of the recorded torque oscillogram.

Basically, there are three groups of these factors consisting of (1) the tap; (2) the material being tapped; and (3) the tapping machine components with which we shall include the tapping coolant or lubricant. Each of these three primary factor groups have within themselves certain characteristics which collectively provide the influencing effect on the tapping torque.

Factors Related to the Tap

The tap presents both metallurgical and physical elements which can be summarized to include all of the following: The material from which the tap is made, generally various types of either high-speed or carbon tool steels; its hardness and torsional resistance to static breaking loads which become an increasing factor as tap diameters decrease; surface treatment and its effect on the coefficient of friction obtained with various product materials being tapped; land widths; flute area and flute shape; flute surface finish, its direction and roughness; lead irregularities; cutting face effective shear angles and keenness; cutting face accuracy of spacing; the chamfer angle, its relief, uniformity, and surface roughness; the thread pitch and thread relief; the surface roughness; the thread pitch and thread relief; the surface roughness of the thread flanks; thread pitch diameter and OD tolerances; and the thread OD relief and surface roughness.

Factors Related to the Material

The material being tapped presents such characteristics as its chemical composition and resulting metallurgical effects which control its hardness, tensile strength, abrasiveness, ductility, plastic deformation and machinability. All of these have some bearing on the chip formation, the optimum shear angle and, in many cases, the resulting work hardening of the metal. As part of the material and one which must be associated with it, we must consider the hole diameters and their uniformity which establishes the percentage of thread depth to be tapped. This factor is controlled to a fine degree by precision reaming after drilling.

Factors Related to the Tapping Machine

Chief among machine factors are its mechanical condition, vibration, weight and balance of spindle type of tap driver, work alignment and tapping speeds. Also included here must be considered tapping coolants and lubricants, and the way they affect tapping torque and the resulting tool performance.

In general, it is considered that cutting forces and torque are independent of speed. However, there appears to be some evidence indicated in tapping certain materials that, because of frictional effects in the chips and flutes and the work done on the chips, speed does have an influence on the torque.

After literally hundreds of tapping torque tests have been conducted on a particular standard tap, under very accurately controlled conditions, an average value is established which is considered representative for that particular tap and its associated tapping conditions. With this representative average value known, a tap modified in any particular respect may be satisfactorily compared to the known standard performance.

In all cases of comparative tapping torque measurements, except under special conditions, the thickness of plate governing the length of thread tapped, is one and one half times the nominal tap diameter, which conforms to standard practice. Conventional tapping conditions are employed and rigidly controlled, to prevent picking up inaccuracies in the oscillograph. The materials tapped in the tests are some of those most universally employed in machining operations, including gray cast iron, low carbon steel and tool steels. In order to minimize the number of tests required in determining tap life, the latter are often heat-treated to various degrees of hardness. In this manner life tests are accelerated in the ratio of approximately twenty to one by the use of a carbon tool steel heat-treated to a hardness of 32 Rockwell C.

Applications of Bonded Wire Strain Gages

By Francis G. Tatnall

MANAGER OF TESTING RESEARCH
THE BALDWIN LOCOMOTIVE WORKS

THE BONDED WIRE STRAIN GAGE is a measuring device reduced to its lowest terms. It has long been known that stretching a wire increased its resistance. This is obvious, because a wire is like a pipe carrying a fluid. When the pipe is lengthened by stretching it suffers a reduction in cross-section. The pressure necessary to force fluids through a longer and at the same time smaller pipe is therefore greater.

Conversely the resistance of the wire would be reduced by shortening it and increasing its cross-section at the same time, but the wire would buckle before it had been compressed very far. However, a reinforcing rod in concrete can be compressed by compressing the concrete column containing the rod, since the mass of concrete enclosing the rod prevents buckling under high compressive loads. In the case of the strain gage, a film of plastic cement is used. The strain gage utilizes a 0.001-in. diameter wire laid in a grid pattern (Fig. 1) about the size of a postage stamp.

When this postage-stamp-size film is fixed with the same Duco cement to the surface of any part which is deforming elastically or plastically, the wire length follows faithfully the deformation in either tension or compression no matter how slow or how fast it takes place. The grid is connected to a conventional Wheatstone bridge, and unbalance of the bridge can be evaluated by almost any commercial type of electrical indicator or recorder for static strains.

Let us review a few of the highlights of possible performance:

Accuracy—Commercial weighing devices are on the market with a guarantee of accuracy of one

Presented at the Annual Meeting of American Society of Tool Engineers, New York, N. Y., March 15-17, 1951.

Fig. 1. The grid arrangement of the strain gage. Fig. 2 shows an analogy between the Wheatstone bridge circuit and an hydraulic circuit. Fig. 3 illustrates a gage design for measuring bending stresses. Fig. 4a shows a design for measuring tension or compression, and Fig. 4b illustrates an arrangement to indicate deflection or in application of the "bent strut" principle.

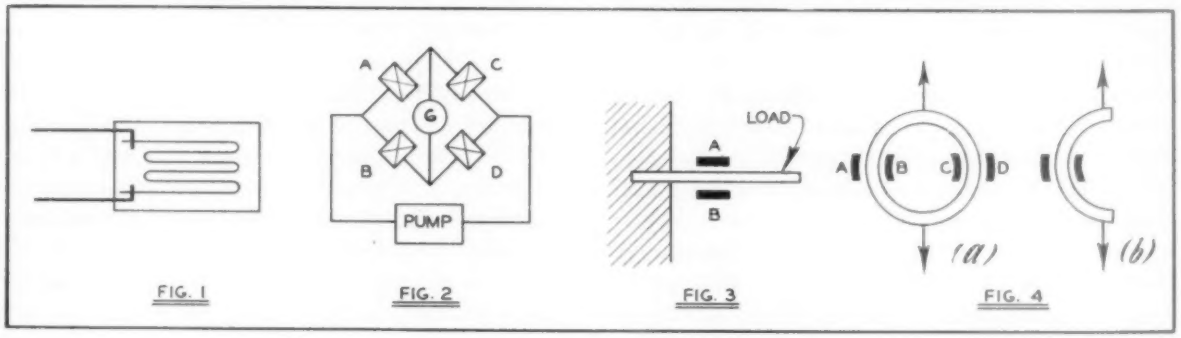


FIG. 1 FIG. 2 FIG. 3 FIG. 4

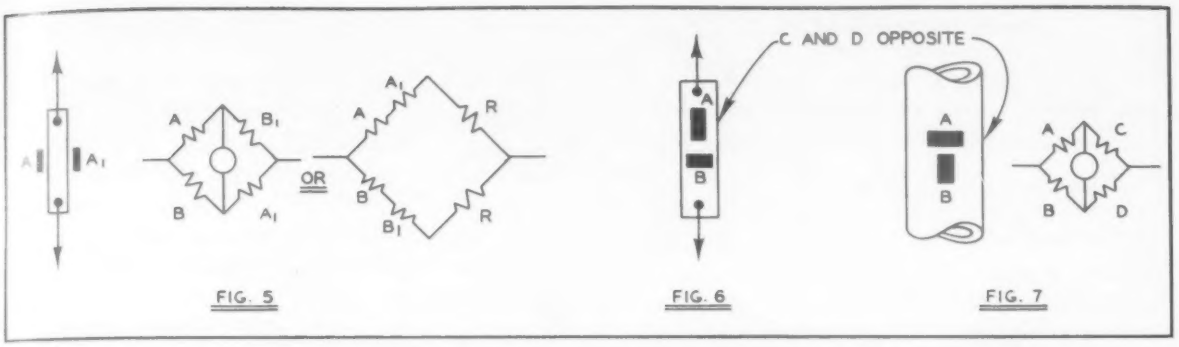


FIG. 5 FIG. 6 FIG. 7

The circuit shown in Fig. 5 measures axial components and eliminates bending. This design uses a dummy gage, which is eliminated in the design shown in Fig. 6, called the *T* circuit. Design shown in Fig. 7 can be used to measure fluid pressure by placing gages on outside of tube.

tenth of one percent of reading above a certain minimum including instrument and circuit inaccuracies.

Sensitivity—Strains can be read to one millionth of an inch per inch with a conventional Wheatstone bridge.

Dynamic response—Measurement of a lagless response has been made up to fifty thousand cycles per second. It is an accepted fact that such response characteristics go on up to much higher values.

Range—Gages have been made that will stretch up to 20 percent with linear gage factor. The average gage will measure up to three or four percent stretch in the plastic range.

Operating temperature—The bonded wire gage principle has been used from the temperature of liquid nitrogen up to 1600 deg F, the latter in operating gas turbine buckets.

Size and shape restriction—The shortest gage is $\frac{1}{16}$ in. From there up there is an almost endless variety of sizes and shapes from multiple gage units to helical gages. In all shapes and sizes the gage is so light that it does not affect the weight or balance of the member to which it is attached.

Stability—When properly cemented, protected from moisture intrusion, and temperature compensated as described later, it is amply stable for all industrial and laboratory uses, some applications being considered permanent such as built-in installations in machinery.

Temperature compensation—Self-compensated gages are available and especially desired for certain extreme conditions. Some circuits are automatically temperature compensating, others use a dummy gage.

Orientation—Gages pick up only strains along their axis and reject other components, thus acting as a component divider. In multiple gage "rosettes" they provide values of magnitude and direction of principal strains.

Conversion from electrical resistance to mechanical strain—The gage factor, obtained by calibration, is provided with all gages. This is a ratio of change of resistance to change of strain, and is dimensionless. For copper-nickel gages this factor hovers around a convenient value of two in both the elastic and plastic range which means that gage resistance changes twice as fast as strain. For another type of wire (iso-elastic) used in dynamic measurements the factor is 3.5.

The output of the strain gage device in micro-volts equals the product of the gage factor times the applied voltage times the number of units of whatever is being measured, such as psi pressure, foot-pounds torque, pounds load, inches-per-inch strain, g's of acceleration, etc.

The Wheatstone Bridge

Three basic circuits are shown in Figs. 2 to 7 and 9 to 11 inclusive, into which almost any commercial application can be fitted to achieve its purpose in the simplest manner. To best understand the basic circuits we must first understand the Wheatstone bridge. Fig. 2 represents an hydraulic system in which the discharge from the pump splits into two equal lines at valves *A*, *B*, *C*, and *D* with a pressure gage to show any differential which may exist between the two parallel pipe lines. As long as all valves are open the same amount the fluid will divide equally between the lines and there will be no differential pressure. If *A* is opened wider than *B*, more fluid flows in the top line. If *B* is closed, still more fluid flows through A, revealed by the gage *G* which is continually measuring the differential. If *A* and *B* be both opened or closed in like amounts there is no differential fluid flow because the fluid is divided equally between the lines. The effect of valve *D* is the same as *A*, and

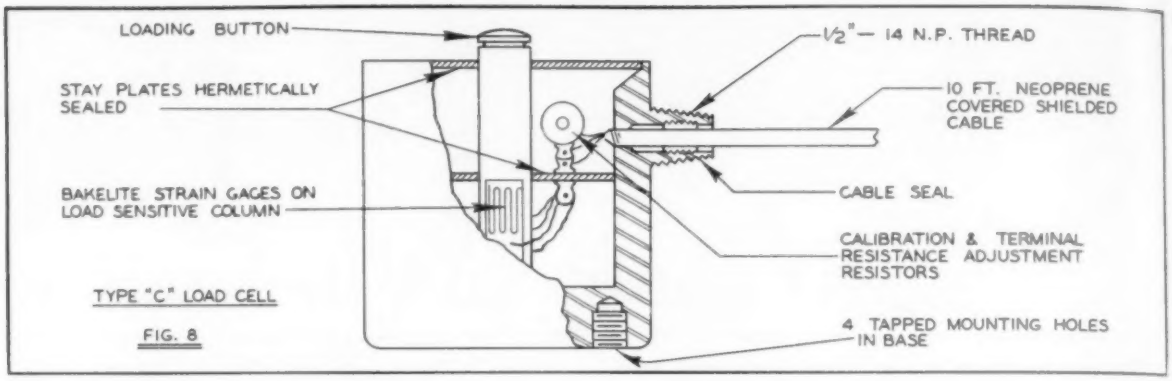


Fig. 8. Commercial application of the fluid pressure measurement principal shown in Fig. 7.

C the same as *B*. To get four times the effect on differential flow, open *A* and *D*, close *B* and *C*.

If the pump in Fig. 2 is replaced by a six-volt battery, an SR-4 strain gage replace each valve, and a galvanometer replace the pressure gage, the electrical effect is the same as the hydraulic. Stretching the gage closes the valve, compressing the gage opens it.

Applications for Basic Circuits

First Basic Circuit—To measure bending and eliminate tension or compression, two gages are placed back to back in bending as in Fig. 3. A load on the cantilever beam, puts *A* in tension, and *B* in compression, which gives double output of the bridge circuit and automatic temperature compensation for this reason, that if the temperature goes up the bar expands, stretching both gages the same amount. Therefore, temperature has no effect on the differential flow but load has double effect. The gages do not differentiate between stretch due to temperature change and stretch due to strain; this system cancels one and measures the other and the same idea can be worked out for all systems. The system has hundreds of industrial uses which most readily suggest themselves, such as force-measuring device of any kind.

There are two variations of this circuit widely in use. Fig. 4a shows a ring which can register either tension or compression load. The ring tends to go elliptical under load which puts the four gages back-to-back in bending with quadruple output and automatic temperature compensation. Fig. 4b shows one-half the ring removed. This arrangement has been used in two ways: As an extensometer or deflection indicator which is caused to operate as the ends move with respect to one another, the gages in bending are transferring large axial displacement into bending strains which can be measured with great sensitivity and precision. This is sometimes called a "clip gage." The second usage is called the "bent strut." After a long column buckles, its ends will travel some distance with very little force applied. This principle is used, for instance, by Brown & Sharpe Manufacturing Company in their new line of shop gages, comparators and instruments.

Axial Components

Second Basic Circuit—The second basic circuit is shown in Fig. 5 which measures axial components and eliminates bending, the reverse of the beam of Fig. 3. If the bar is loaded in tension and is slightly bent to start with, this unwanted bending can be averaged out by using two gages back-to-back at *A* and A^1. While the bar is straightening, one gage will be in tension, the other in compression. When the bar is finally straight and starts to take tension, both gages go into tension. This must be connected in the circuit in such a way as to neutralize bending and measure axial load. Connecting the gages in series or in diagonally opposite arms will do this. But they are not automatically temperature compensating in this way because they are now measuring both the strain due to load and the strain due to temperature change. This is where the "dummy gage" comes in. For each live gage, one dummy *B* is cemented to the same kind of material at the same temperature but is unstressed. The dummy measures strain due to temperature change only and is connected as shown; it cancels temperature and leaves strain due to stress standing alone.

A variation of this circuit does away with the dummy gage and is called the *T* circuit, as in Fig. 6. Two gages are mounted back-to-back to pick up the axial strain and two others are mounted at right angles. These latter are strained only in lateral contraction due to Poisson's radio effect, hence the output is amplified by 1.3 where 0.3 is the value taken for Poisson's ratio. It will be noted that the gage at right angles to the loaded gage is strained in opposite manner to the loaded gage.

Measuring Fluid Pressure

The same system is employed to measure fluid pressure by placing gages on a tube (Fig. 7) which is carrying the pressure to be measured. As the internal fluid or gas pressure goes up or down the tube radially expands or contracts elastically. Two gages are placed so as to be strained by the circumferential deformation with two temperature compensators *B* and *C* at right angles, lengthwise with the tube in a manner which is unstressed. This is the basis of commercial pressure cells and engine indicators and numerous other such uses. They respond dynamically quite as effectively as they do statically. Fig. 8 shows a commercial pressure cell. Two other applications of pressure measurement differ from the above: Very low pressures are measured on diaphragms carrying gages in two directions at 90 deg, or helically wound gages, so as to pick up the bi-axial strain. Or, a differential pressure arrangement employs two tiny syphon bellows (Fig. 10), each of which is connected to a different pressure. Their differential movement bends a cantilever beam carrying gages strained in bending.

Third Basic Circuit—The circuit shown in Fig. 9 is designed to measure torque or twist. In a shaft subjected to torque, shear forces lie normal to and along the axis, with tension and compression components at 45 deg. Since wire gages can only measure tension or compression, four gages can be so placed along these 45 deg components as to measure torque or twist in terms of tension and compression. In a rotating member, the four-arm complete bridge can be fed through two slip rings with the unbalance being taken off through two other slip rings. Thus, both static torque or torsional vibration can be measured. If an electric tachometer output be fed into the circuit, the readings are directly in horsepower. A *T* circuit on the shaft, one on each side, as shown in Fig. 9, will simultaneously measure thrust and cancel bending.

Fig 11 shows two forms in which the multiple-gage "rosettes" are applied commercially to structural members to provide direction as well as magnitude of maximum and minimum principal strains. Half the difference of the two principal strains automatically gives the value of the maximum shear.

Finally, a basic service which the gage performs for the tool engineer, requiring no special circuit arrangement, is to reveal values of residual strain in structure. A single gage or a rosette is cemented to an area to be sectioned from the part. Any other means which will relieve residual strain at the location of the gage, such as the simple drilling of a hole at the point of intersection of the center-lines of three gages, will measure the value of the residual strain, evaluating the strain relaxation shown by the gage or gages as strain is relieved by the sectioning.

The strain gage technique can also be applied to temperature measurement for exceptional sensitivity. For this purpose, the gage is made with temperature-sensitive nickel wire and is cemented in place in the usual way, bridge unbalance being read in terms of degrees Farenheit or degrees Centigrade.

Varied Applications

All of the above listed forms of industrial measurement, of which there are hundreds of variations, can be read dynamically as well as statically. All frequencies from static to impact transients can be recorded on commercial instruments, whether these be rapidly varying loads, forces, displacements, accelerations, batch weighing, railroad scales, resonance studies, measurements of peak fluid or gas pressure, water hammer, explosions such as gun firing, or dynamic torsional modes.

Amplified bridge unbalance can operate servomechanisms, run motors, turn valves, trigger safety power cut-offs, or can be built into machinery as permanent installations for load measurements, regulation, or control means. Bridge unbalance signals can be telemetered by radio with precision or commuted electronically so as to read a large number of parallel bridges at ultra-high speeds.

Fig. 9. This gage design is used to measure torque or twist. Differential pressure indication is illustrated in Fig. 10. Fig. 11 shows application of rosette designs applied commercially to structural members to indicate direction as well as magnitude of stresses.

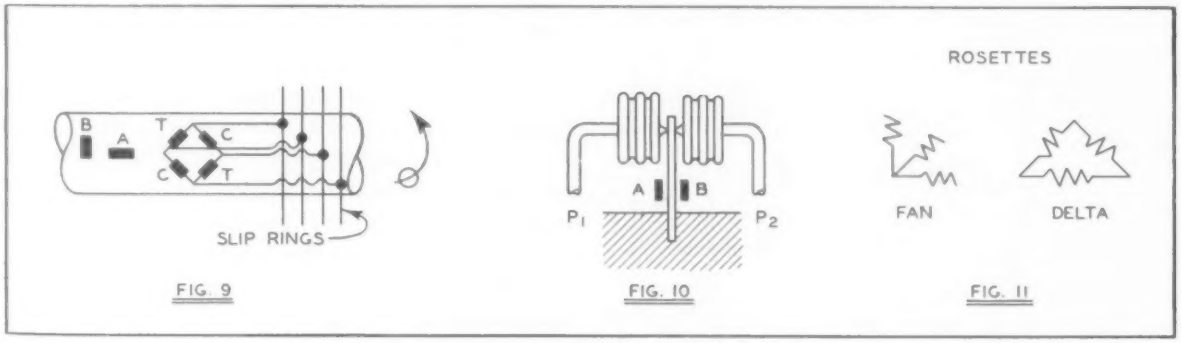


FIG. 9 FIG. 10 FIG. 11

Plant Layout and Facilities for Precision Manufacturing

By G. A. Richroath

MANUFACTURING ENGINEER
SPERRY GYROSCOPE COMPANY

THE PROBLEMS OF PLANT layout in Sperry Gyroscope Company's Lake Success plant have to do with relatively small-quantity manufacture of high-precision products, generally of a complicated design.

At the conclusion of World War II, from having been arranged for large-scale line machining, the company was confronted with contraction of operations and the necessary rearrangement of the entire machine shop layout, so as to produce items in small quantities and many varieties, with frequent design changes.

Machine Shop Layout

Re-planning of the machine shop layout was done on the belief that small-lot work, involving frequent changes of set-up, minimum tooling and related problems, can best be served by what is commonly called a "Colony" type layout.

The distinctive principle of this type of shop is the concentration of general-purpose departmental tooling, machine accessories, machine facilities and operator skill. Having all the skill available at one location, the foreman can usually select the level of skill needed, depending upon the nature of the task. A smaller amount of top skill is generally required under these conditions, which is favorable from a cost standpoint.

The colony set-up has the disadvantage that somewhat more movement of material is required. This objection can be minimized at the time of layout by carefully planning the arrangement of the various colonies with respect to each other. There is, for example, a considerable amount of natural flow of parts from automatic screw machines, to second-operation bench lathes, and hand screw or turret lathes. By locating these departments adjacent to one another, the distance for movement of material is reduced and control of the items usually stays in the hands of the same production dispatcher.

This principle is illustrated in Fig. 1, which shows layout of the main machine shop. Here, the main colonies involved in a particular flow pattern of detail parts are shown in white; dispatching areas are vertically hatched; inspection areas are diagonally hatched, and tooling and auxiliary services are shown dotted.

The parts that pass through these colonies are generally small, except for castings which usually do not exceed 12 in. square.

A small percentage of parts are somewhat larger, measuring approximately 2 to 3 feet square. These are machined complete in the heavy machining shop. This shop contains boring mills, radial drills, vertical turret lathes, jig mill, and other machines which generally provide all that is needed to completely machine the large parts. Layout facilities, large inspection surface plates and parts-washing equipment are also provided. Adequate monorail equipment is available to facilitate handling throughout the area. This shop has been carefully placed on the outer edge of the area on a main aisle to provide accessibility for trucking without crossing through the main shop.

Presented at Annual Meeting, American Society of Tool Engineers, March 15, 1951.

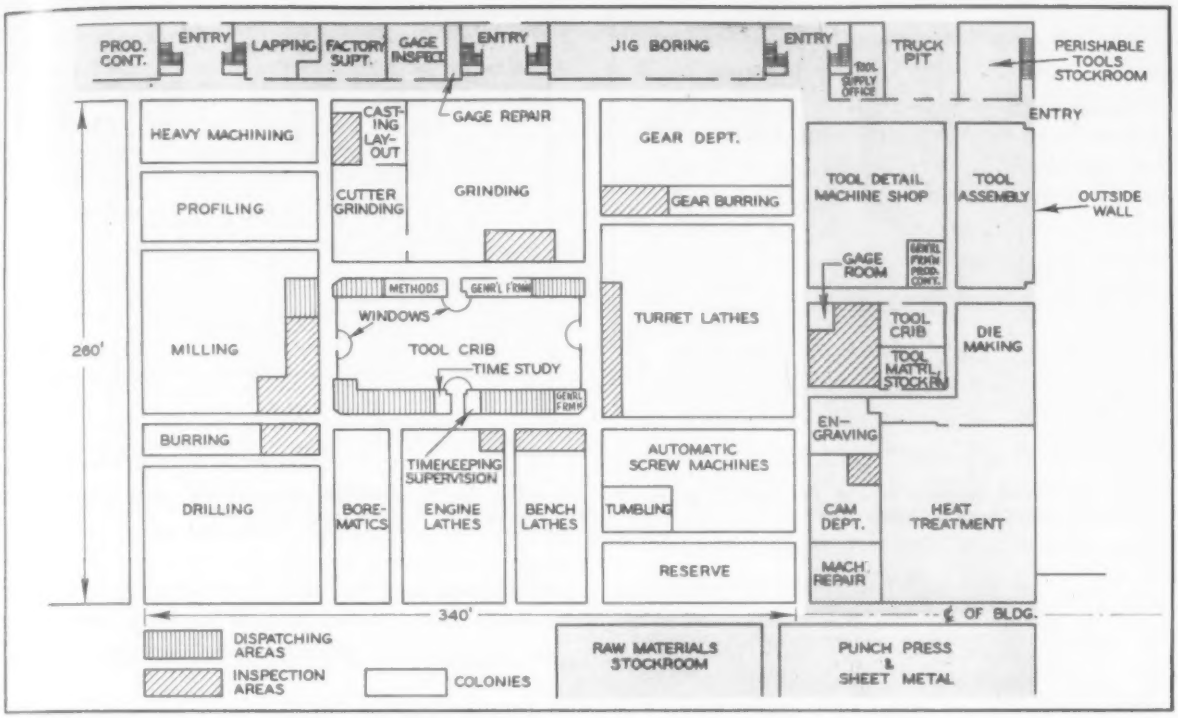


Fig. 1. Colony-type layout of main machine shop.

General Shop Layout

The general objective in the machine shop layout was to locate all service functions in the center or hub of the shop, so as to minimize travel of operators for service.

The large central tool crib contains all machine-shop tools for active products. Having all the tools in one crib has many advantages:

1. Only one set of location cards need be maintained.
2. More efficient use is made of Crib Tenders.
3. Supervision is easier.
4. There is minimum duplication of perishable tools, gages and measuring equipment.
5. Quality control re-inspection of tools and gages is easier to police.

The crib operation is quite efficient in that tools are dispensed from all four sides, each side specializing in the tools specially needed by the adjacent colonies. The active jigs and fixtures are located close to the service window for convenience, with gages and perishables also close at hand. Special tools are stored in the usual manner, but only one set of cards is used to indicate the aisle and shelf location. This file is maintained by a clerk located in the center of the crib, and crib tenders obtain location information over a two-way communication system, without having to go to the file themselves.

An 8-foot trucking aisle circles the crib for convenient transfer of parts from one colony to another. On two sides of the tool crib, a strip of space has been allowed for some of the important shop services. Most of this space is used as drop area for parts waiting at the various colonies. Dispatching leaders, general foremen, shop methods men, timekeeping supervision, and time study personnel also make their headquarters in this area.

Inspection areas, and offices of timekeepers and various section foremen, are located directly opposite these services, across the trucking aisle. By such arrangement, the shop operating supervision and service personnel are located close together at the point of principal activity.

The service aisles between machines are not shown in Fig. 1. These all point toward the tool crib and, since the shops are not more than 100 feet deep, most operators have less than that distance to walk for tools.

The cutter grinding department has been located close to the milling areas in order that special requirements can be conveniently obtained.

Work Station Layout

Operator performance is sharply governed by the efficiency of his work station. Therefore, careful attention must be given to the small details of station layout, such as the tool stand and the tote stand. The types and arrangement of facilities should be standardized and shown on layouts, and not left to the foreman's individual judgment.

Many small but important details can be taken care of when templates of machines are made for use in layouts. Some details that can be included in the template are:

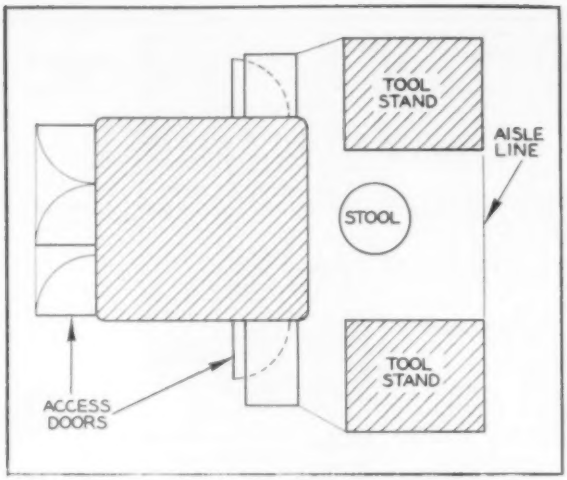


Fig. 2. Work station layout for 4 x 12 plain Landis cylindrical grinder.

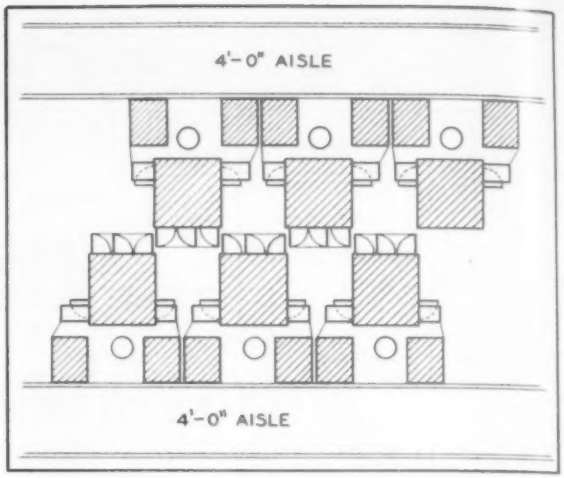


Fig. 3. Application of template principle to a group of Landis grinders.

1. Show the tool and tote stands so positioned that the operator can reach parts and tools without moving from his work position (a sitting position where practical).
2. Show arc swing of service doors.
3. Show position of operator's stool.
4. Include distance from face of machine to aisle.

Fig. 2 shows a typical template for a 4 x 12 plain Landis cylindrical grinder, including such details. If such practice is consistently followed, the work stations will be efficient, uniform, neat in appearance, provide better operator comfort, and contribute to a better safety record.

Colony Grouping of Machines

When groups of like machines are laid out in a colony, several additional requirements should be considered:

1. Standardize width of service aisles and call for painting of aisle lines.
2. If possible, allow access for chip removal from the rear, so as to avoid interference to operator.
3. Leave room for general maintenance and lubrication.
4. Provide reasonable access for cleaning the machine and adjacent floor area.
5. Review the layout to see if all safety angles have been considered.

Fig. 3 shows application of the template principle to layout for a group of Landis grinders.

Such shop service functions as tool making, jig boring, cams making, engraving, heat treating, and punch press and sheet metal working, have been located outside of the general machine shop area, as these are not particularly involved in the flow pattern of details in the main shop.

Tool Room Layout

The tool room, one of the most important departments in any plant, has been set off in one corner, which keeps the tool and die makers away from the general shop activity and, by locating them along the window line, provides more daylight for their critical work.

The layout and operation of the tool room is affected by the fact that a large percentage of the tool work is done by machine hands. The shop is self-contained, having its own complete machine shop, tool crib and auxiliary stock room.

The general break down of this area is shown in the upper right hand corner of Fig. 1. All tools are here broken down into detail parts, which are made in the tool room's own machine shop. These parts are then collected and routed to tool or die assembly, where the final construction is done by tool or die makers. This is worked out to such a degree that many tools require very little tool or die makers' time for completion. Such related functions as tool inspection, heat treating, and perishable tools inventory stores are located adjacent to the tool room for convenient service.

The punch press and sheet metal shop is somewhat remotely located from the general shop area. This shop is quite active in the production of radio-type chassis, large consoles, miscellaneous weldments, complex drawn shells, and laminations. Most of these parts or assemblies are completed in the sheet metal area; therefore there is no hardship in its remote location. The raw material stock room is located directly opposite the shears and slitters in the sheet metal department. Bar stock from this stock room is also convenient to the automatic screw machine and turret lathe departments, where most of this type of material is used. Such arrangement is important in reducing the handling and trucking of hazardous materials.

Layout for Assembling Operations

In the manufacture of such precision products as watches, gyroscopes, and high speed spindles,

precision assembly will not necessarily follow just because the layout for assembling is superlative. Some of the things more important than layout include:

1. Parts that are functionally perfect.
2. Highly effective assembly technique.
3. Education and policing of employees in cleanliness.
4. Creation of employee interest, and impressing them with the importance of their task.
5. Adequate methods and tooling.
6. Careful design of general facilities.
7. Good housekeeping.

Probably the most universally used equipment in assembly is the operator's bench. Fig. 4 shows an assembly bench specially designed by Sperry, which has contributed to more efficient assembly. Its features include:

1. No leg interference, allowing operators to be placed at any desired spacing.
2. Electrical outlets provided on three-foot centers.
3. Linoleum top facilitates cleaning and improved general appearance of area.
4. Trough under bench is convenient for pocketbooks and lunch boxes.
5. Bench is adaptable to conveyor belt, since "X" leg construction leaves room for return of belt.
6. 4 x 9 ft size of bench accommodates six assemblers on small assembly work.
7. 4 ft width is sufficient for average assembly work and takes less floor space than commercial benches back-to-back.
8. Foot rail is also provided.
9. Cost of bench made-to-order is less than commercial equivalent.

Tote boxes should be kept off bench tops as much as possible, for reasons of cleanliness and to use bench space more efficiently. To facilitate this, tote stands can be provided, as seen in Fig. 4. They are generally provided for each station on small assembly work. The tote stand accommodates six small tote boxes without interfering with assemblers' space on 3 ft centers. The stand contains two drawers, assigned to the day and night shift employees for their personal tools. Each drawer contains a small removable slide drawer which the operator uses for his small tools.

Where smoking is permitted, a special ash tray is attached to the under side of the bench. Vacuum cleaning is extensively used in assembly areas, and a specially designed vacuum outlet nozzle is shown in Fig. 4. It can be operated with one hand, the vacuum being turned off and on with the thumb by rotating knurled collar on the barrel.

Sperry assembly departments are broken down into four types, each separated from the other: 1. Wire preparation and cablemaking; 2. Motors, transformers and coils; 3. Electronic chassis assembly, and 4. Final product, mechanical assembly.

The wire preparation and cable making departments manufacture all harness assemblies used throughout the plant. They also do all wire cutting, lugging of wires, cutting and marking of identification sleeves, and hot tinning of leads prior to soldering.

The motor, transformer and coil departments assemble motors, transformers and coils used in all products. Details for these units are supplied from the general machine shop. This department also contains a special shop which supplies all engineering development demand of these items.

The assembly departments are generally laid out in simple line arrangement. Progressing from drop areas, the flow of parts and operations is characteristically through shelving, assembly benches, drill stands, inspection stations, and shelving again. Each product usually has test facilities, the test area being set up adjacent to assembly. On large products, the spacing of aisles between benches is increased to allow for required surface plates on assembly stands. Final product assembly is set up in separate departments for each product.

Assemblies of an extremely critical nature, such as gyroscopes or synchronizers, are accomplished in special assembly rooms which have electrostatically filtered dust control in addition to temperature and humidity control. The test of the unit is accomplished within the room under the same controlled temperature as the assembly. Considerable saving in cost is realized through reduction of rejects. The improved uniformity and increased accuracy of the product will usually justify the expenditure for such facilities when the product is of a critical nature.

Fig. 4. Assembly bench of special design. Note electrical outlets, tote stands, vacuum nozzle, X-leg construction.

Continuous and Automatic Gaging

By A. C. Sanford
FEDERAL PRODUCTS CORPORATION

Part I

AN AUTOMATIC GAGE IS A MACHINE designed to perform inspection of certain parts on a production line basis without the necessity of many operators. It generally consists of the following: a hopper; a metering or feeding device; a measuring device, and provision for disposal of the measured product.

The part leaves the hopper and then has to be carried through the gage unit by a propelling or metering device. The propelling or metering device may take the form of a motor-driven reciprocating slide, rotating table or any one of a number of forms.

The disposal on a gage is basically a series of doors which open or close at the right time and direct the already measured parts into the correct disposal box. These doors replace the operator's hand motions in picking up a measured part and putting it into the correct disposal box. Such doors and chutes can be operated by means of solenoids which, in turn, are operated by the gaging unit.

The devices suitable for or adapted to continuous gaging or automatic measuring can be broken down into the following rough classifications:

1. Air type (gages)
2. Electrical contact type (switches)
3. Electronic and electro magnetic type (gages)
4. Penetration type (gages)
5. Other gages

Presented at Annual Meeting, American Society of Tool Engineers, March 15-17, 1951.

Air Gages

An air gage is essentially a device in which a metered amount of air is passed through an orifice. The metering is generally accomplished by a restrictor in the upstream side of the air line from the orifice. The orifice is usually mounted in a plug, ring or similar device suited to the shape of the workpiece. When brought near to a workpiece, the flow of air through the orifice is restricted. This change causes a change in the flow, back pressure and velocity in the upstream side from the orifice. A suitable indicating device is placed in the upstream side.

Some indicating devices use a manometer tube to measure the back pressure, others use a Bourdon tube or bellows-actuated dial indicator type, and others use some form of flow or velocity indicator. Most types of air gages can be made to operate electrical pressure switches. Once the air gage has been made to operate a differential switch, it is an easy matter to have this electrical current operate signal lights, disposal trap doors or auxiliary mechanism.

The air gage has certain advantages and disadvantages, for both continuous gaging and automatic gaging. Where the part has a high finish or may be very fragile, such as finished aluminum foil, the air gage does have an advantage in that the actual measuring pressure is low enough so that there is little chance of marking the part.

Among the air gage's several disadvantages, is the fact that, for continuous measurement, the space between the two measuring jets or between the measuring jet and the solid reference, as the case may be, is fairly limited. In general, this clear-

ance is a matter of a few thousandths of an inch greater than the thickness of the material being measured. Another disadvantage of the air gage is that, for automatic gaging purposes, it is considered to be relatively slow. The average air gage, although having adequate speed for hand gaging operations, but, when used for automatic measurement, the speed limit of such an air gage is on the order of 50 to 60 separate measurements per minute. Many applications requiring high accuracy have to be run at a slower rate to allow stabilization.

Electrical Contact Type (Switches)

The electrical contact or switch type unit most generally incorporates a spindle similar to that of a dial indicator, which actually touches the work. Changes in the size of the workpiece move the spindle, and this spindle in turn operates switches. Operation of the switches, one of which is usually provided for the high limit and one for the low limit, sets up electrical circuits which can be used to control disposal traps or auxiliary equipment.

Several makes of this type of unit are available, all of them similar in basic operation. Fig. 1 shows the combination switch, indicator unit.

The Electricator is usually used in conjunction with a power unit. Each of the switch contacts is tied in with the grid circuit of a thyratron tube which is basically an electronic relay. When the switch contact is closed it causes the thyratron to fire. Due to the nature of the thyratron, the circuit is non-reversible. If a borderline piece is being measured, and the contacts close momentarily, the thyratron tube will go into operation and, regardless of how much the contacts chatter, a steady signal is received. This is very essential for automatic gaging. If the circuit is not instantly self-holding or non-reversing, traps and other elements will chatter and may produce error in measuring.

The switch-type unit has several advantages. It is the least expensive basic measuring device available commercially which will set up an electrical impulse, in accordance with the size of the part. The repeat characteristics of this type of unit are very good, especialy considering that it is a fairly inexpensive piece of equipment. Generally the repeat characteristics of this unit are on the order of twenty-five millionths of an inch or better. While this means that the unit can be use for fairly close tolerances, using the customary 10 percent gage maker's tolerance, it is suggested that these be used for nothing less than plus or minus 0.00025 in. There have been cases where they have been used for 0.0001 in., but it must be understood that gage maker's tolerance is being exceeded.

The main disadvantage of this unit is that it is a mechanical device. As such, it is possible, if the spindle is moved too rapidly, which may happen when pieces are passed under it, to have a little

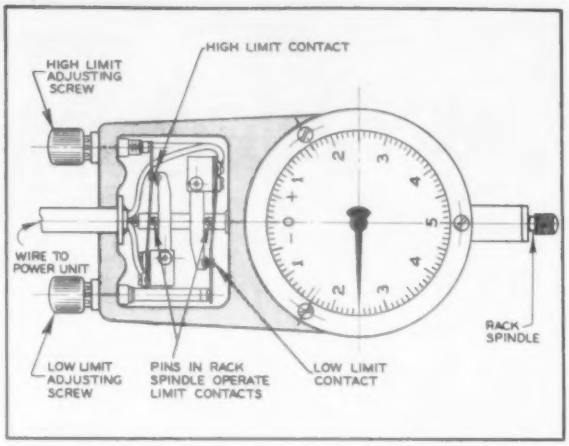


Fig. 1. Typical electrical combination switch with indicator unit, generally used in pairs to regulate high and low limits.

bounce at the electrical limits. This may cause some apparent inaccuracy at one of the limits. In general, this type of unit is not used for jobs where more than perhaps 70 or 80 pieces per minute have to be checked.

Electronic and Electro-Magnetic Gages

Electro-magnetic mechanical and electronic mechanical types of gages look somewhat similar when viewed superficially. With the electro-magnetic or electronic comparators, as a piece is moved in under the spindle, the spindle moves and the change in size is shown on a meter. In the electro-magnetic type of gage, the spindle generally moves an iron core between a couple of coils. This type of gage is generally run with 60-cycle current flowing through the coils. The electro-magnetic type of gage can be made extremely sensitive and with high magnification. Some gages have scales graduated in a few millionths of an inch.

However, despite the electrical actuation of such gages, certain time lags are inevitable. Suppose that an automatic gage is to be built for measuring a small cylindrical piece, the piece to pass underneath either a cylindrically radiused contact or one with a very small flat. Since a cylindrical piece is being introduced under a cylindrical anvil, the maximum dimension or the time for which the spindle will be in its uppermost position is going to be very short. With the gage operating on 60 cycles it requires, perhaps, 2 cycles or roughly 1/30 of a second for the electrical circuit to reach equilibrium. That means that the piece has to be under the spindle for at least 1/30 of a second and probably a little bit more, to allow for a safety factor. This may sound fairly fast, but time is required to get the piece from the hopper chute over in front of the metering device, push it to the gage, through the gage and then down through the disposal chute; this 1/30 of a second is, therefore, not very fast. It limits the possible gage de-

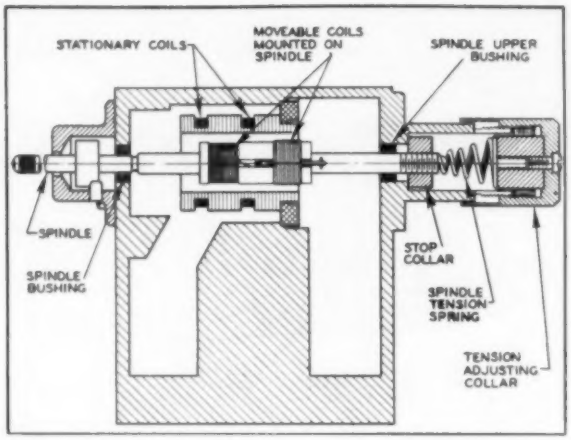


Fig. 2. The electro-mechanical automatic gage, which provides high speed gaging plus high magnification.

sign to a maximum speed of possibly 60 to 70 pieces a minute.

The electronic-mechanical type, which again is familiar in the form of a comparator, looks somewhat the same as the electro-magnetic type, but it does have some important differences. In this type of gage (Fig. 2) one coil is attached to the spindle and two fixed coils are inside the gage head. Movement of the spindle, in accordance with size changes of the part, changes the relative position of the spindle coil to the other two coils. This is not too much unlike the 60-cycle gage. There is an important difference, namely that the current passing through these various coils is operating at 100,000 cycles or more per second. Assuming the same conditions as just described, i.e., the small cylindrical piece passing under the spindle, if two or three electrical cycles are allowed for the circuit to reach equilibrium, 1/30,000 of a second has been used for the measurement.

The Scovill Manufacturing Company rolls out brass wires used to make zippers. As this wire is pulled through the Turks head, the wire drawing machine occasionally jerks the wire. This unevenness in the pulling causes sections of the wire to become necked down. They are smaller than the rest of the wire. When the wire is finished, it is put into automatic zipper-making machines. When one of the undersize or necked-down sections goes through the machine, the machine is not affected but it makes a zipper which will not stay closed. An electronic gage was put on this job and it was found that small necked-down sections could be picked out which went by in about one five-hundredth of a second. It is possible in that extremely short time to pick that size signal up and operate auxiliary equipment, either to mark the wire, shut the machine off or do whatever else might be desired.

This high speed is not as yet entirely practical for automatic gaging because of limitations on speed of material handling. However, electronic equipment has already been built to be used with customer's material-handling equipment which will measure the rollers in roller bearings, and carrying manufacturer's guarantee of a rate of 400 pieces per minute.

The electronic mechanical gage also has the advantage of being able to provide extremely high magnification with scales graduated in millionths.

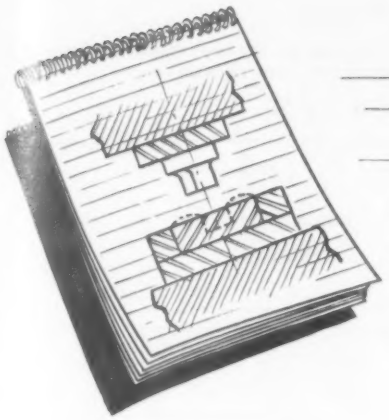
This type of unit has the same disadvantages as any type of gage which must touch the work. It must actually contact both sides of the work that is to be measured. It is, therefore, not at all suitable where one of the requirements of the job is that the work cannot be touched. This would be the case where thickness of very soft material must be measured. In continuous measuring it cannot be used where the material has a widely varying pass line or where it is extremely hot. This is a case such as the hot strip mill or flying shear in a steel mill. For applications such as that there are other types of gages, which are more suited.

Penetration-Type Inspection Units

For those applications where contact cannot be made with the material, such as paper in its initial stages of manufacture, the previously mentioned hot strip mill, and similar applications the penetration-type gage offers perhaps the best approach to date.

The penetration-type gage may utilize X-Rays, Beta particles, gamma rays or similar radiation. A source of emission which may be an X-Ray tube or a piece of radio-active Carbon 14 or similar material is placed on one side of the material which is to be measured. The receiving device is placed on the opposite side. Since the distance between these is not too critical, provided it is constant, plenty of clearance can be provided to allow the material to pass through. That is one of the reasons why this type of gage is well-suited for measuring something like hot strip steel continuously. The emitted rays pass through the material which is to be measured and are received and noted by the receiving end of the gage. On the way some of these rays are scattered or lost so that the amount received is less than the amount emitted. The difference can be calibrated in terms of material thickness.

Generally this type of gage is set up almost as though two gages were operating simultaneously. One gage constantly measures the thickness of a known sample, which serves as a master for the gage. The measurement received from that unit which is on the actual production line is compared electrically with the reading from the master gage and the difference is shown electrically on an indicating meter.



A notebook on die design....

By John S. Brozek
SARGENT AND COMPANY

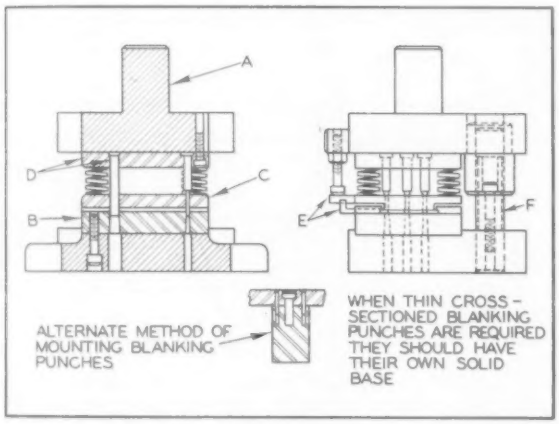
Class B Die

Construction of dies of this type are to be made of first class workmanship and material for medium production requirements where dimensions are not important.

A. Specify semi steel die sets to suit requirements.

B. Die block should be made to thickness best suited to work but not less than 11/16 inch thick; cutting parts of the die are to be within limits of plus or minus 0.003 in.; die to have ¾ deg taper for entire thickness.

C. Stripper in. to be of machine steel; loose fit around punches.



D. Blanking punch should be set in as part of the punch holder; minimum punch holder plate of ½ thickness made of a good grade of tool steel.

E. Automatic stop should be provided with feed finger only when necessary.

F. Bumper block must be provided when forming, lancing, extruding, or embossing is performed.

G. Clearance and alignment of punch and die should be such as to produce blanks fairly smooth, but small burrs are permissable.

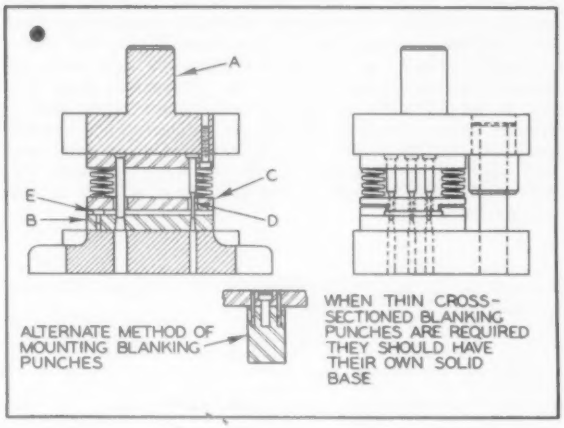
Class C Die

Dies of this type are to be of first class workmanship and material. This type of die is for small production requirements and is classified as temporary.

A. Specify standard cast iron commercial die sets to suit requirements.

B. Die block should be made to ½ in. or less in thickness; cutting parts of the die are to be made within limits of plus or minus 0.005 in.; die to have ¾ to 1 deg taper entire length.

C. Stripper to be made of thin machine steel plate; loose fit around punches.



D. Blanking punch and piercing punches are to be short, mounted in a machine steel plate held with screws only in the punch holder.

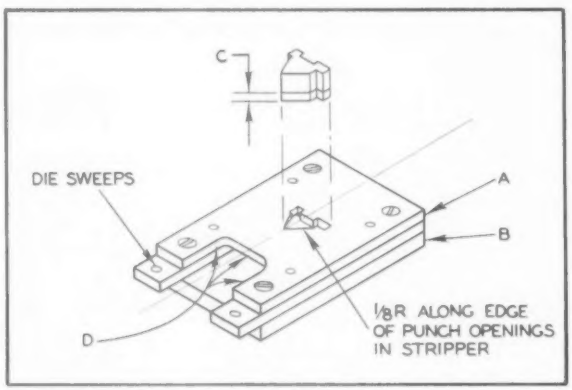
E. Pin stop should be provided for positioning for blanking.

F. Clearance to suit short run work.

Continental Die

Dies of this type are to be of first class workmanship and material. This type of die is used for short run work or on experimental runs to prove a given product.

A. Die block should be made ½ inch thick; cutting edges of the die are to be held to limits required to make the blank to product drawing; the die block should be tapered one deg the full length.



B. Stripper is used as a guide for the blanking punch and should be made ⅜ inch thick; top side of stripper plate should be rounded to allow ease in locating punch prior to blanking; stripper should be doweled and screwed.

C. Blanking punch should be straight for ¼ inch along the cutting edge tapered back with a 2 to 3 deg taper.

D. Clearance should be a little greater than normal die clearances to reduce blanking pressure; burrs are permitted.

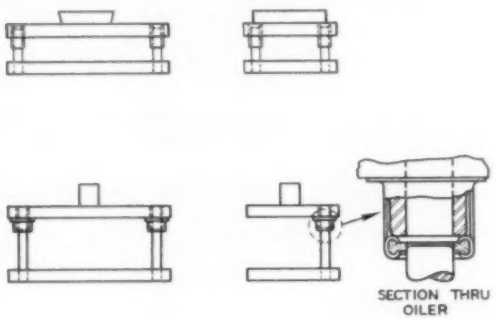
Cut out of Stripper to allow for bowing up of heavy material. Position of cut out in relation to die opening should be such as to govern feed by sight.

Elements To Be Considered For Proper Die Layout and Construction

1. Selecting The Die Set

The die set should be specified according to "Type of Die Classification". For thin material, or where extreme accuracy is required, die sets with four guide posts and extra long bushings should be specified to keep better alignment of punch and die. The die designer should see to it that in all die sets specified, the guide pins and bushings are of sufficient length as not to disengage on the upstroke of the press. Disengagement causes excessive wear on the pins and bushings because of difficulty of keeping lubricant between the guide post and the bushings. Due to conditions beyond the control of the die designer such as presses with extra long stroke and limited shutheight with close frame construction it is difficult to specify a die set to meet the above requirement of keeping guide pins and bushings in engagement. Therefore, provisions must be made to specify standard guide post covers with oilers to be mounted around the guide bushings. This type of oiler will keep the guide pins wiped with oil on each stroke of the press.

Correct die set application where extreme accuracy is required or thin material to be worked



Correct die set application with ram at top of stroke where disengagement takes place

2. Die Block Layout

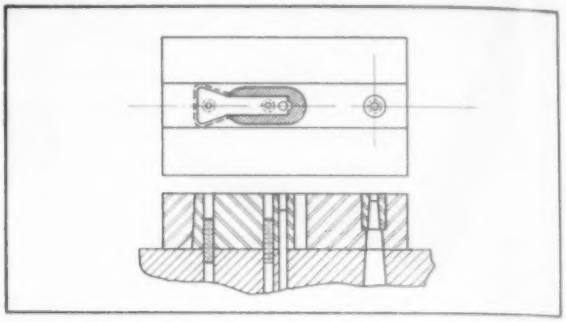
In laying out the die block for a blanking die or blanking station of a progressive die, it is important to have sufficient amount of metal around the die opening.

For materials up to 3/16 inch thickness, the following will be applicable:

3. Insert Weak Projections

All delicate projections on the die should be inserted for economical replacement in case of breakage.

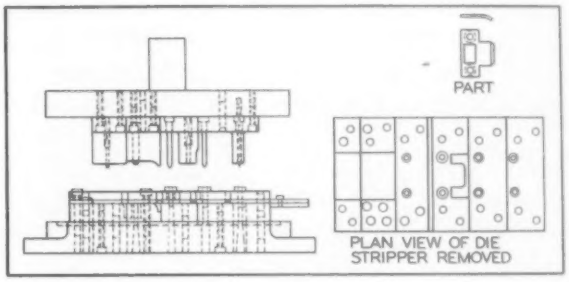
4500 Retractor Blanking Die



Note: A ¼ deg taper on a side is filed in the die block at the point of insertion, positioned from the bottom of the die to act as a locking member. The insert is tapered to suit the die block opening.

4. Does The Die Have Sufficient Sections

A separate section for each station is a safe rule when designing progressive dies. Where the product is complicated, more than this is necessary.



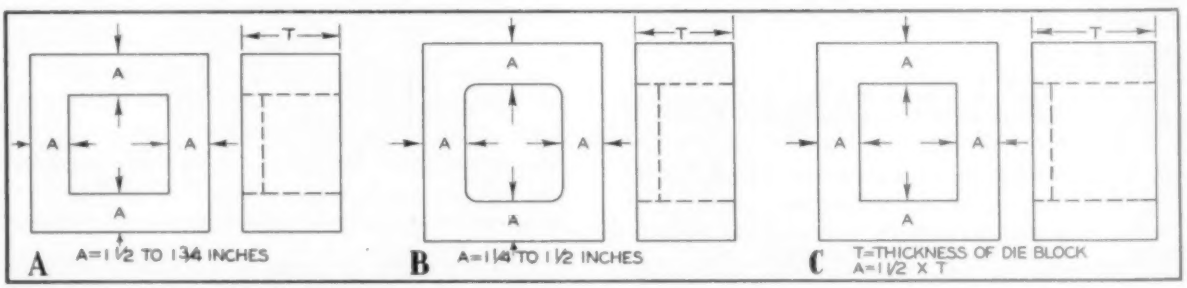
If there is not sufficient amount of metal around the die opening to withstand the shock produced when blanking, the die block is likely to crack in service.

Where die sections are 1½ inches or over in thickness a good policy for allowing metal around the die opening would be as follows:

Sharp Cornered Die Opening
A = 1½ to 1¾ inches

Round Cornered Die Opening
A = 1¼ to 1½ inches

T = Thickness of Die Block
A = 1½ x T



Note: All screws and dowel pin holes should be at least ½ inch from die opening or cracking in hardening may result. Therefore, at times it may even require greater length of dimension "A" in order to eliminate this hazard.

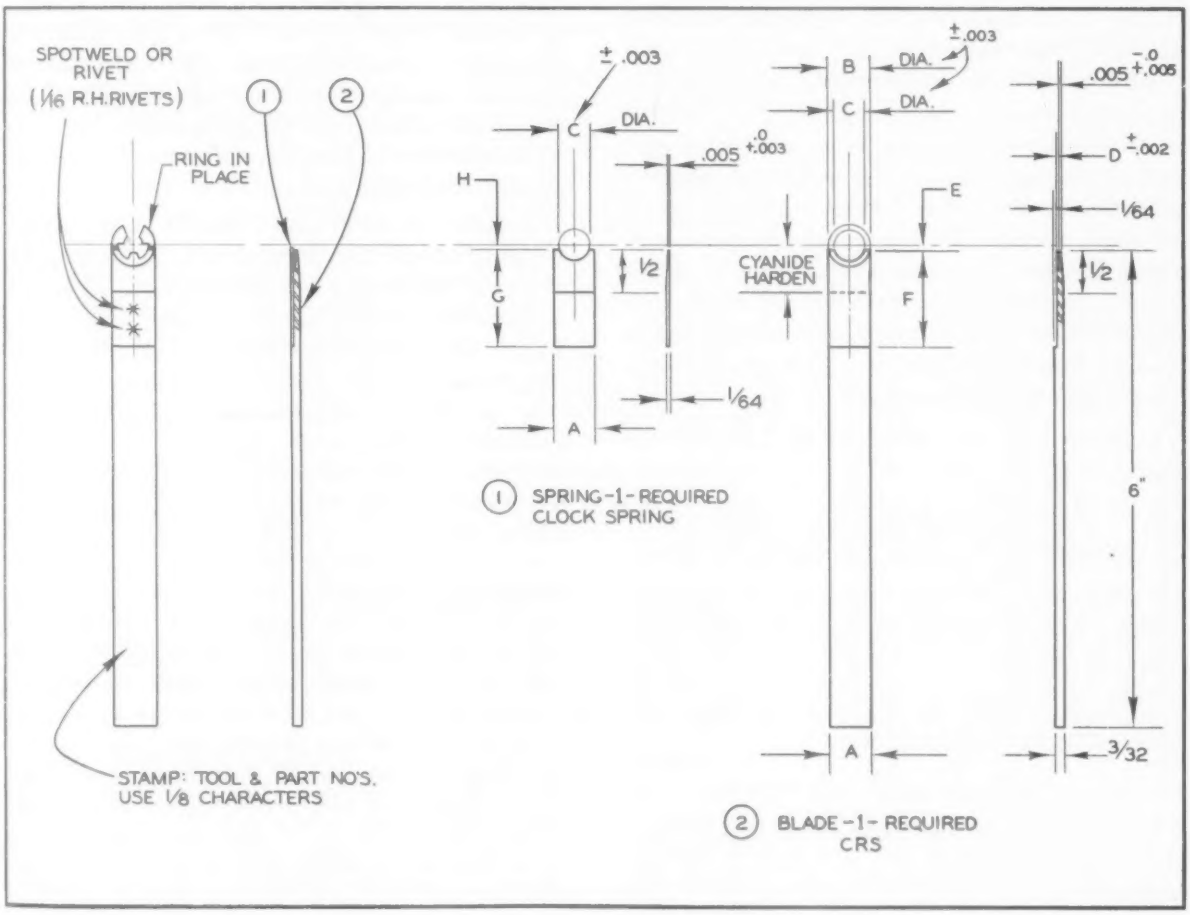
Hand Tool Aids Snap Ring Insertion

By Frank Martindell

PROJECT ENGINEER
TELETYPE CORPORATION

ASSEMBLY TOOLS FOR WALDES KOHINOR—TYPE E RETAINING RING

RING NO.	A	B (Ring O.D.)	C	D	E	F	G	H	Ring Thickness
5133-6	3/16	.156	.109	.007	1/32	31/32	1	0	.010 ± .001
5133-9	1/4	.187	.141	.010	1/32	31/32	1	0	.015 ± .001
5133-12	1/4	.230	.156	.010	1/32	31/32	1	0	.015 ± .001
5133-14-S	1/4	.203	.125	.010	1/32	31/32	1	0	.015 ± .001
5133-15	9/32	.282	.219	.020	1/32	31/32	1	0	.025 ± .0015
5133-18	5/16	.335	.250	.020	1/16	15/16	1	0	.025 ± .0015
5133-25	1/2	.527	.406	.020	1/16	1 5/32	1 3/16	1/32	.025 ± .0015
5133-31	1/2	.500	.375	.020	1/16	1 5/32	1 3/16	1/32	.025 ± .0015
5133-37	1/2	.660	.438	.030	3/32	1 5/32	1 3/16	1/16	.035 ± .002
5133-43	1/2	.687	.562	.030	3/32	1 5/32	1 3/16	1/16	.035 ± .002
5133-50	1/2	.800	.656	.037	1/8	1 5/32	1 3/16	5/32	.042 ± .002
5133-62	1/2	.940	.812	.037	1/8	1 5/32	1 3/16	5/32	.042 ± .002



Statistical Aids for Tool Engineering

By Lawrence E. Doyle

ASSISTANT PROFESSOR OF MECHANICAL ENGINEERING
UNIVERSITY OF ILLINOIS

Part IV—Statistical Answers to Tool Engineering Problems

THE BASIC STATISTICAL methods for estimating distributions of errors or variations in manufacturing were described in Part III. They have been applied most extensively to inspection problems. Two main uses have been to establish acceptable quality levels in going operations and to provide means for checking results economically. The tool engineer, too, is interested in refinement of current production, but he must also cope with the problems of production before it starts. One of his chief activities is to prepare the plans and supply the tools for future production. In doing that he can make use of principles of statistics to estimate the probably effects of tolerance accumulations, as described in Part II. Other uses of statistics in tool engineering are:

1. Discovering and correcting the causes of errors.

2. Finding the practical manufacturing limits for a dimension as a basis for setting tolerances.

3. Determining whether a method or operation is likely to meet the specifications for which it is proposed.

4. Finding the limits to which machines and tools can be expected to work.

5. Estimating the effect of tool wear.

Ways of dealing with those kinds of problems by the use of statistics will be taken up in this article.

Some Qualifications of Statistical Quality Control

In Part III, it was observed that statistical quality control relies upon the control chart. Samples are taken in small sub-groups. The averages, and often the ranges, of the sub-groups are plotted on the control chart. Lines for the averages and control limits for the points are established from statistical relationships.

It should be noted that a control chart reviews performance and does not guarantee a future course of events. However, it is a good indicator of future performance. As long as the averages remain well within limits, evidence continues to accumulate that control is being realized. The limits of variations are defined with assurance that they will be maintained as long as the causes of error do not change materially. Occasional appearance of points on one side or the other of the mean or slightly outside the limits may not be cause for alarm.

Establishing Trends

A series of points on one side of the mean or with a decided trend indicate lapse of control. Suppose that in a pan there are a large number of pieces of a nominal one inch diameter, and that half are larger and half smaller than the nominal size. The probability of picking out a piece larger than 1 inch diameter is ½. If there are many pieces, the probability of getting a second large one is also near ½, and the probability of picking out two

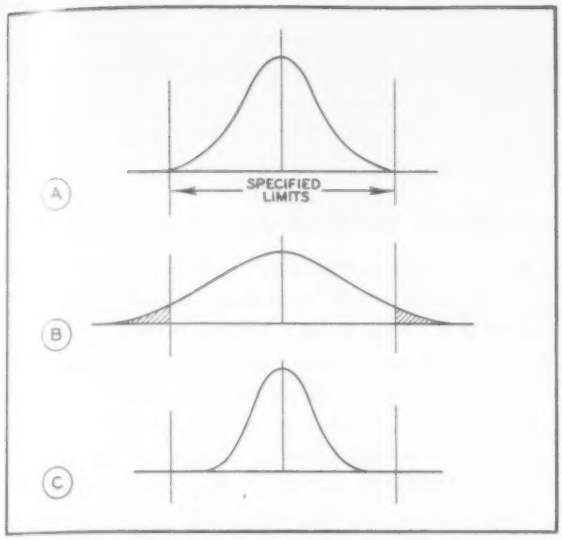


Fig. 1. Relation between specifications and performance limits.

large pieces is $\frac{1}{2} \times \frac{1}{2} = \frac{1}{4}$. By the same reasoning, the probability of getting 7 large pieces in succession, say, is practically $(\frac{1}{2})^7 = 1/128$. Thus, within a run of that amount, there is much less chance of all the pieces being on one side of the mean than that some will be high and some low. On the same basis, the probability is very small that a long series of points representing sub-group averages will fall on one side of the mean if the universe is nearly symmetrical. The theory of runs is a part of statistics that has been developed in detail to interpret trends in plotted points. From it, rules have been derived to indicate unsatisfactory conditions. One of them is that if 7 successive points are on a control chart and are all on the same side of the center line, a lapse of control is indicated. Likewise, 10 out of 11, 12 out of 14, 14 out of 17, or 16 out of 20 successive points give indications of a shift in performance. In addition, a few points close to a control limit give warning of trouble.

Sufficient Points Necessary

It is necessary that enough points be available on a control chart and that they show a satisfactory situation if the chart is to be any good as evidence. Generally, the plotted points of at least 25 successive sub-groups must fall within the control limits. If not more than 1 out of 35 successive points, nor more than 2 out of 100, fall outside the control limits, a safe condition may be said to exist as a rule.

It is important to remember that *the shape of the actual distribution of a universe determines to a large extent the reliability of the results derived* from a series of measurements. Thus, it is quite possible for a real distribution to be unsymmetrical, and many are more or less so. Exact information on the shape is difficult to find and is rarely available in practice. Fortunately, the errors in most controlled processes are nearly symmetrical, and most may safely be assumed close to normal.

Specification Limits

The 3 $\triangle$ limits produced by a process must not be confused with the specification limits of the product. Seldom are these two identical. The 3 $\triangle$ limits of a process reflect what the process is able to do. The specification limits express what it is *hoped* the process will do. In Fig. 1 are shown the specified limits that confine the tolerance of a dimension. The ends of the curves stand for the practical limits within which various processes might perform.

At *A* the two kinds of limits coincide. For case *B*, the deviations indicated by the shaded area are produced outside specification limits, and represent defects. The process depicted by *C* performs well within the tolerance.

Discovering and Correcting the Sources of Errors

Statistical quality control does not of itself correct unsatisfactory conditions. It can only give evidence of their existence and clues of their sources. A control chart is capable of showing whether errors result from one or a few dominant causes, which can be eliminated profitably, or from a multitude of causes too small to suppress profitably.

If statistical analysis indicates the presence of assignable causes of error in an operation, an investigation is in order. Quite often the positions of the points on a control chart point to certain causes of error. It may be that the average needs to be shifted to a more favorable level. That calls attention to those adjustments in the machine or tools that establish the average. As another instance, haphazard and widely spaced points may signify looseness in stops or slides.

Example 1. As an illustration of events indicative of trouble, results for a second and third day, not necessarily successive, were added to the table of Fig. 4 and the chart of Fig. 5 in Part III. On those days samples were taken every hour. On the second day most of the pieces remained within limits. The standard deviation and range averages moved a little above the central line but stayed well within limits. The $\overline{X}$ points, however, shifted decidedly, to and above the high limit of the chart. Thus, although the dispersion does not appear changed materially, the average or mean has changed dangerously and an appreciable part of the production may be expected to exceed the maxi-

mum specification and have to be reworked. This is a condition that results sometimes from the operator trying to be too safe and work to the high limit. Then, again, he may not be paying sufficient attention to adjustments to compensate for grinding wheel wear, or his working gage may be in error.

Analyzing the Operation

On the third day the $\overline{X}$ points are distributed about the central line, although two exceed the limits. But of more significance is the excessive dispersion of the standard deviation and range average points. Several faults in the conduct of the operation are likely. If the operator is working to a stop for size, he may not be approaching it uniformly. The stop or some other member of the machine may be loose. The workpieces may be coming to the operation with too wide a variation in the stock to be removed. Whatever the cause, there is reason to believe that it can be found and corrected, inasmuch as under original conditions control was realized.

The cause of trouble is not always obvious, even if a control chart shows lack of control. In such cases, the use of statistical methods may be extended to track down the source of trouble. The first step is to look over the operation and note the most likely places where assignable causes of error may be. For instance, typical areas for suspicion might be the movement of a carriage to a stop, the action of a chuck, the rough workpiece on raw material, and the gaging of the workpieces.

The next step is to devise significant means of checking the action in each suspected area. For a carriage brought to a stop, an indicator may be set to show the position reached each time the carriage is moved to the stop. For chucking, a workpiece in the chuck may be indicated each time the chuck is closed. Rough workpieces may be measured for relevant dimensions. To check an indicating gage, one workpiece may be measured at regular intervals.

Set Up Control Chart

The third step is to run a control chart on each factor being investigated. For instance, four successive indicator readings of the stopped position of a carriage may be combined into a sub-group, their average and range computed, and corresponding points plotted on $\overline{X}$ and range charts. Four more successive observations may then be treated in the same way, and so on until 20 or more points have been plotted. Averages and control limits for the plotted points should be computed.

Any cause of error that shows one or more points out of limits or an unbalanced condition may be looked upon as an assignable cause and should be corrected. Causes that give evidence of control cannot likely be changed without radical changes in the operation. After all factors have been proven or corrected the overall variations may be rechecked.

Corrections for Controlled Operations

In the search for trouble, it may be found that the variations of an operation exhibit a state of control but their spread is larger than permitted be specifications. Under such circumstances, partial changes are not likely to prove sufficient. Two courses are open. One is to change radically the nature of the operation or design of the equipment. The other is to change the specifications.

One example that has been given of an operation apparently in control but outside of specification limits involved thread milling. A tolerance of $\pm$ 0.003 inch was required on the thread, a total of 0.006 inch. A control chart indicated control but a spread of 0.17 inch. Investigation revealed that the clamping mechanism on the head was frail and allowed large deflections under load. The variations in deflection were random but excessive. After the clamp was redesigned and rebuilt to cut down the deflections to very small amounts, performance of the operation was brought within 0.006 inch as required.

Operations Reversed

Another case that has been given is that of an engine lathe operation of facing a shoulder to give a 0.168 to 0.176 in. diameter at the end of a ground taper. Although the tolerance required was 0.008 inch, a control chart showed the natural tolerance range of the operation to be 0.025 inch as it was being done. A gage was supplied the operator, and it helped cut down the performance range to about 0.016 inch, but that was still too much. To get within specifications, a complete reversal was made. The operation of facing the shoulder was put first and that for grinding the taper later. In the grinding operation, a natural tolerance of 0.007 inch was held for the face diameter at the end of the taper.

If the evidence of a control chart is reasonably uniform and efforts are not able to reduce the variations, a change in specifications may be considered. Tolerances that are notoriously hard to hold are not respected. But when requests are made to change specifications, it is well to have them supported by ample evidence of necessity of change. For that purpose, observations should be made and recorded over much more than a minimum period. Such observations should indicate a high degree of restraint within performance limits as evidence of sincere efforts at control.

Engineering Aspects of Tool and Die Welding

By Arthur R. Butler

PRESIDENT
WELDING EQUIPMENT AND SUPPLY COMPANY

Part V (Conclusion)

Oxyacetylene Welding Tools and Dies

OF THE THREE FUSION processes utilized to weld tools and dies: metallic arc, atomic-hydrogen arc and oxyacetylene, the latter has proven to be the least effective, hence has not been popular.

An important factor contributing to success in tool and die welding is the volume of heat, created by the fusion processes, coupled with the localization or concentration of that heat. This results in rapid quench which insures hardness of weld depositions without affecting adjacent areas. The metallic arc (6200 deg F) is the fusion process that has the most localization in its heat effects, followed by the atomic-hydrogen arc (7200 deg F). The oxyacetylene fusion process affects a considerable portion of the parent metal, tending to decrease hardness of areas adjacent to the weld area. While hardness of the weld depositions can be increased by utilizing a carburizing flame (excess of acetylene) at the torch tip, which induces carbon, it does not enhance the hardenability structure and properties of adjacent affected areas.

A positive exception to this conclusion is the use of the oxyacetylene method in the welding of high speed steel cutting tools which is reviewed below.

Oxyacetylene Welding of High Speed Steel Cutting Tools

The welding and brazing of high speed cutting tools came to the front during the recent war because of the abject shortage of high speed steels. The most practical way to repair cutting tools, as indicated by experimentation and actual practice, is by the oxyacetylene welding method. Utilization of the metallic arc welding method was generally discarded because of the concentration of extremely high heat at the arc, inducing checking and cracking of the tools being welded.

Cracked cutting tools are repaired by brazing with silver solder or other low melting alloys. However, this is a separate phase and is not covered herein.

Repairing High Speed Steel Cutting Tools: Repairs are effected by the oxyacetylene welding method to teeth and flutes on milling cutters, broaches, drills, ball and end mills, reamers, taps, cutting tools for lathes, planer and shaper, and specially shaped forming tools. In addition tool life can be prolonged by building up areas that are worn to the extent that they are no longer usable.

Much time and material can be saved and production facilitated by these types of reclamation. Valuable heat-treating time is saved because the "hard-as-welded" deposits of high speed welding rods are as easily ground as conventional high speed steel. The dimensional distortion sometimes experienced in heat-treatment is also eliminated. Susceptibility to rebreaking is minimized because the weld deposits become integral parts of the tools.

Fabrication by Welding of High Speed Steel Cutting Tools: All types of cutoff, turning, grooving and special shaped forming tools, lathe centers, centerless grinder blades, etc., can be compositely fabricated by using a mild, medium carbon or SAE 1335 steel as a base. Blanks to which the high speed steel welding rods are applied are machined in the same manner as is customary in preparing for carbide inserts. The requisite stock is built up with high speed steel welding rods and as the weld deposits are "hard-as-welded," the tools are simply tempered and then ground to finish size. To facilitate machining, the weld deposits can be annealed and the compositely constructed tool can then be heat-treated.

High Speed Steel Welding Rods

There are two types of high speed steel welding rods which are commonly used for oxyacetylene

welding of high speed steel cutting tools as well as for compositely fabricating cutting tools.

One type is a cast ferrous alloy that incorporates the characteristics of high speed steel from the standpoint of toughness, and at the same time provides the wear resistance of cemented carbide. The weld deposits have cutting qualities of cobalt-tungsten high speed steel. Rockwell hardness, secured as-welded and "drawn," approximate 60-66 on the Rockwell C scale. The weld deposits have high red hardness and resistance to abrasion. The cast alloy rods are recommended for applications requiring maximum resistance to abrasion such as on lathe centers, centless grinder rests and spinning tools.

The other type is a cobalt-molybdenum-tungsten high speed steel welding rod which is drawn wire. This type is easier to apply because the drawn structure tends to eliminate porosity in weld deposits which is sometimes experienced in applying the cast alloys. The weld deposits secured with these welding rods have excellent cutting qualities comparable to or excelling the conventional high speed steels, combined with excellent abrasion-resistant qualities. The hardness secured with welding rods of this type will approximate 61-65 on the Rockwell C scale. Contours are more easily maintained in utilizing the drawn rod rather than the cast rod. This minimizes the grinding necessary after welding. The drawn structure of these rods also minimizes the susceptibility to embrittlement and the weld deposits will take heat-treatment similar to the typical high speed steels.

Heat Treatment

Typical heat-treatment for cast ferrous high speed welding rods follows: annealing temperature, 1600 deg F; cool slowly in furnace. To harden, preheat to 1500-1550 deg F, transfer to a furnace at 2000 deg F, quench in air. Draw at 1000-1050 deg F.

Typical heat-treatment for drawn cobalt-molybdenum-tungsten high speed steel welding rods follows: annealing temperature, 1500 deg F, cool slowly in furnace. Heat slowly, 2150-2200 deg F. Quench in oil or salt bath. Draw at 1000 deg F.

For tools used in intermittent cutting, it is advisable to resort to a second draw of 1075 deg F.

The weld deposits of both types of high speed steel welding rods, the heat-treatments of which are given above, are air hardening to a reasonable depth, as applied on hardened sections. Complete heat-treatment, other than drawing or tempering, is generally not necessary. For best results in composite construction where the requisite build up is heavy complete heat-treatment is recommended.

Procedures

In repairing high speed steel cutting tools, the high speed steel welding rods are applied by the oxyacetylene welding method, using a carburizing or an excess on the acetylene flame. The surfaces where the weld deposits are to be laid must be clean. When building or repairing damaged or worn cutting edges all edges and corners must be ground down to allow for deposit.

All surfaces to be faced should be brought to a sweating heat before attempting to fuse the high speed steel welding rods to the parent metal. Flux should be utilized to aid in combating the oxidation of the highly alloyed high speed steels. It is important that the flame of the welding torch penetrate below the outside oxide skin before applying the high speed steel welding rod. Excessive puddling of the deposited metal should be avoided as it is not necessary because of the high fluidity of these rods. Caution should be exercised, in applying successive layers, to work out all oxides from previous deposits to eliminate the possibility of porosity.

For repairing hardened steel parts, a preheat of some 600-1000 deg F is recommened, depending on the size of the object; the smallest object taking the minimum and the largest the maximum preheat; the range in between being proportionate. The maintenance of constant temperature, as nearly as practical, during the welding operation is of vital importance. In welding hardened high speed steels, depreciation of hardness in areas adjacent to the weld may not be experienced in a reasonable degree if the flame of the torch is manipulated correctly.

After welding, all tools should be drawn or tempered, which will increase the hardness and toughness of the weld deposits. Generally a draw of 1000 deg F is ideal.

In compositely constructing cutting tools, by utilizing a mild, medium carbon or SAE steel shank, preparation should be made to allow for a minimum depth of deposits of $\frac{1}{8}$ in. to minimize the admixture of the deposited metal with the base metal, with its resultant decrease of hardness. A preheat of 300-400 deg F before welding is recommended. After welding, all tols should be drawn which will increase their hardness. As in the repair of cutting tools, the drawing temperature of 1000 deg F should be utilized. In order to secure the maximum hardness a double draw, 1000 deg F and subsequently 1050-1070 deg F, can be utilized.

Conclusions

Tool and die welding need not be mysterious or complicated. It is highly important to industry, and the tool engineering profession is becoming more and more cognizant of the service it can render industry.

It is stressed that present-day labor and material costs are high and that this economic picture demands that industry resort to successful reclamation of tools and dies rather than replace defective units.

JIC Hydraulic Standards for Industrial Equipment

(Continued)

H6.3.7 (A) When pistons are assembled to rod they shall be positively locked.
(B) Flow of fluid into non-rotating cylinders shall be at extreme tops of bores or other means provided to prevent entrapment of air.

H6.3.8 When necessary, cushions shall be provided on cylinder ends.

H6.3.9 Wherever possible, cylinders shall be so used in the circuit or circuits as to subject the solid head ends of cylinders to high pressure, and not to gland or rod ends.

H6.4—Valves

H6.4.1 Adjustable valves shall be arranged so that wires and seals can be used after final adjustments and locking.

H6.4.2 Valves shall not be mounted in reservoirs except in selfcontained units. Where valves, including solenoid operated valves, are mounted in reservoirs, they shall be kept above high fluid level, so maintenance and adjustments can be made without draining fluid, except where the function of the valve requires same to be below the oil level.

H6.4.3 Gasket mounted valves shall be used whenever possible so their removal and replacement can be made without breaking individual fluid lines. Gaskets of the pressure sealing type are recommended. Gasket mounted valves shall have locating pins.

H6.4.5 The operation of a valve shall not produce detrimental surges in the hydraulic system.

H6.4.6 On vertical or inclined slides or rams means shall be provided to prevent rapid drop when hydraulic power is shut off.

H6.4.7 Solenoid operated valves shall be so designated, constructed and installed as to eliminate destructive hammering.

H6.5—Accumulators

H6.5.1 Accumulators shall be so constructed as to withstand at least five (5) times the operating pressure of the hydraulic system it serves.

H6.5.2 Accumulators shall be so designed and constructed that they cannot be dis-assembled while containing an unsafe gas charge. Means shall be provided for safely relieving accumulator gas and oil pressure.

H6.5.3 Hydraulic circuits incorporating accumulators shall be so arranged that the system can be bled at the high point of the circuit.

H6.5.4 See paragraph H7.1.3 of the "Safety" Section.

H6.6—Accumulator Nameplate

H6.6.1 The following information shall be permanently indicated on each hydraulic accumulator:
(A) Manufacturer's name and address.
(B) Manufacturer's identifying model number.
(C) Manufacturer's serial number, if any.
(D) Rated maximum operating pressure.
(E) Charging medium.

H7—Safety

H7.1.1 Flexible lines shall be restrained or confined if their failure might constitute a hazard to personnel.

H7.1.2 Operator shall not be required to reach past revolving spindles, moving tools, or moving machine or equipment elements to reach manual controls.

H7.1.3 Hydraulic circuits incorporating accumulators shall be so interlocked as to vent or isolate accumulator fluid pressure when power is shut off. On circuit applications where accumulator pressure is isolated full information shall be given on or near accumulator for proper servicing without injury to personnel.

H7.1.4 In hydraulic systems where gas is used over 250 psi nitrogen or other inert gas shall be used.

Engineering Developments

Standards specifications noted with an asterisk (*) were written as a guide in indicating the type of engineering that is considered to be desirable in new developments and in the re-engineering of equipment.

PROPERTIES AND AVERAGE VALUES OF SOME THERMOPLASTIC MATERIALS

(Data from P.M.M.A. Handbook)

	CELLULOSE-ACETATE	CELLULOSE-ACETATE-BUTYRATE	ETHYL-CELLULOSE	VINYL-CHLORIDE-ACETATE	ACRYLIC	NYLON	POLY-ETHYLENE	POLY-STYRENE	VINYL-IDENE CHLORIDE (SARAN)
Price (Rel.) 5M. Lbs. Bracket	.44 and .50 colors trps.	.56 colors and transp.	.62 and .66 reg. spec.	.42 and .54-56 inj. extrus.	.70 and .75 clear colors	1.60 to 2.25	.48 to .57	.27 and .31 and .355 trp. color spec.	.54 and .56 blk. natl. colors
Color	trp. trl. op. unlimited	trp. trl. op. unlimited	trp. — trl. opaque	trp. — trl. op.	trp. + trl. op. unl.	trl. to opaque	trl. to opaque	trp. + trl. op. unl.	trp. — trl. op.
Specific Gravity	1.27-1.34	1.17-1.25	1.12-1.17	1.35-1.45	1.18-1.19	1.09-1.14	.92	1.05	1.65-1.72
Impact Strength	.3-5.2	.6-5.4	2.0-8.0	.4-.75	.4-.5	1.5	no break 1.6 at —40 deg F	.25-.40	.3-1.0
Coefficient of Expansion Linear Maximum per deg C	$8\text{-}16 \times 10^{-5}$ * .002-.012	$11\text{-}17 \times 10^{-5}$ .002-.012	$10\text{-}20 \times 10^{-5}$ .002-.009	$6.9\text{-}18.5 \times 10^{-5}$ .001 max.	9×10^{-5} .002-.006	$10\text{-}15 \times 10^{-5}$ .015	$16\text{-}18 \times 10^{-5}$ .02-.05	$6\text{-}8 \times 10^{-5}$ .002-.006	19×10^{-5} .005-.025
Heat Distortion 66 psi Load, deg F	131-245	138-233	115-190	140-155	160-185	320-400	N.A. srd. test. 185 max temp. continuous	180-210	190-210
Tensile Strength	1900-8000	1900-6800	2000-8000	7200-9000	7500-10000	10900	1300	5000-9000	3000-5000
Flexural Strength	2600-13500	1500-9300	4000-12000	12600-14500	13000-17000	14600	N.A. —	8000-16000	4500-6000
Water Absorption	1.9-5.7	1.1-2.2	.8-1.8	.07-.08	.3-.4	.4-1.5	<.01	.03-.05	<.1
Dielectric Strength	290-600	250-400	300-530	375-400	450-500	385-470	420	400-700	350
Elongation (percent)	3-69	38-75	5-25	———	2-10	50-135	200	1-3.6	20-200
Rockwell Hardness	R49-R123	R59-R117	R70-R110	———	M84-M105	R111-R118	R11	M65-M90	M50-M65
Resistance to Weather	crazing with prolonged (6 mos.) exposure	ultra-violet inhibited formulas commercially uneffected 12 mos.	1 yr. good to fair. Only special compositions are resistant.	slight darkening and stiffening depending on stabilization.	slight discoloration on uncolored resins.	slight discoloration	degrades badly in 6 months except special compositions	varying degrees of yellowing and crazing and degradation of properties.	darkens slightly first 3 months exposure—slight change thereafter
Effect of: Weak Acids	slight	slight	slight	none	practically nil	none	none	none	none
Strong Acids	disintegrates	disintegrates	decomposes	none	attacked by oxidizing acids	attacked	none	attacked by oxidizing acids	highly resistant
Weak Alkalies	slight	slight	none	none	practically nil	none	none	none	resistant
Strong Alkalies	disintegrates	disintegrates	slight	none	practically nil	none	none	none	resistant
Organic Solvents	soluble in alcohols. Little affected by hydrocarbons.	better resistance to more solvents than is cellulose acetate.	widely soluble	resists alcohols and hydrocarbons	affected by hydrocarbons and esters	resistant to common solvents	none below 50 deg C	soluble in aromatic and chlorinated hydrocarbons	range is good,—fair—to excellent resistance

NOTE: * = Mold shrinkage, in./lin. in.

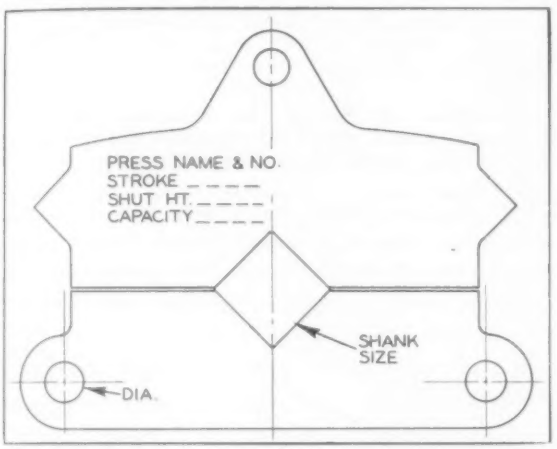
Courtesy Tennessee Eastman Corp.

Gadgets

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Templates for Press Rams

A handy and inexpensive aid to die designers is a set of full size templates of the rams of O.B.I. type punch presses. They can easily be made by tracing around the ram when in down position or, if a light film of oil is rubbed on the ram, a primary template may be made from the oil outline and transferred to the working template. The latter should be made of stiff paper or, if greater durability is desired, of clear sheet plastic.



Templates of press rams, such as shown, save time in layout and helps prevent errors when designing or purchasing dies.

The template should contain center lines of the shank hole; information as to press make and number; press stroke; shut height; and rated capacity. Shank and mounting hole diameters should also be included. Tapped holes for bolting upper dies on punch holders directly to the ram are readily located and laid out from the templates.

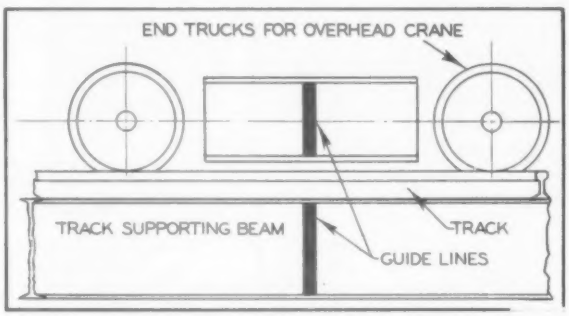
These drafting aids should prove particularly useful when designing or purchasing die sets, since one can immediately check interferences, such as location of leader pins that might come inside the ram area when the die shuts. This holds true for dies that do not raise the punch holder off the pins in operation.

As another time saver, one can use this template to quickly establish interchangeability of die sets with different presses. By laying the template on top of a die drawing, it only takes a matter of seconds to determine if a die set can be mounted in any given press, thus obviating time and labor of actual trial.

Lamar Schwalke
St. Louis Chapter, ASTE

To Spot Cranes

Where material must be recurrently crane-lifted to and from machines, the time required can be considerably shortened by merely painting guide lines on the carriage and supporting beams. The method has proven itself quite effective in our plant.



Guide lines painted on crane beams and carriage facilitate crane spotting.

When a crane operator receives a call for a lift, all he has to do, to get the crane hook over the center of the lift, is to align the guide lines. The line on the carriage indicates the hook center and the line on the supporting beam indicates the point of pick-up. To provide for different locations it may be necessary to paint a number of lines on both runway and cross beams, numbering them to suit location.

J. H. Quatkimeyer
Cincinnati Chapter, ASTE

To Identify Steel

The usual method of identifying steels, in shops lacking metallurgical labs, is by the spark test. This consists of grinding a piece of steel of unknown analysis and comparing the sparks with those of a specimen of known grade.

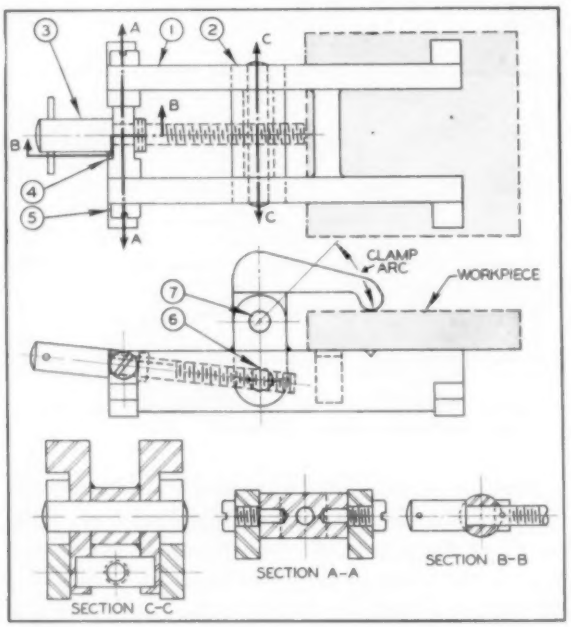
By grinding one piece at a time, however, the tester cannot compare the sparks together but must rely on visual memory. Therefore, the logical procedure is to grind the two pieces simultaneously, one on each side of the wheel. The sparks can then be visually compared.

Federico Strasser
Santiago de Chile

The Tool Engineer pays regular page rates for accepted contributions to these pages, with a minimum of $5.00 for each item.

Parallel Vise Aids Clamping

Conventional drill vises are rather limited in capacity and a considerable proportion of work in tool and die shops is either too large for them, or too small to be supported on parallels and yet clear the drill when breaking through. The parallel vise shown, which is designed to supplement rather than replace standard vises, obviates most of these difficulties.



The parallel drill press vise shown may be used for clamping of flat parts which, ordinarily, are too large for conventional vises. Body and clamp are of welded construction, and the feet, extending beyond the sides, permit drilling outside the actual body area. Construction details are further shown in sections A-A, B-B, and C-C.

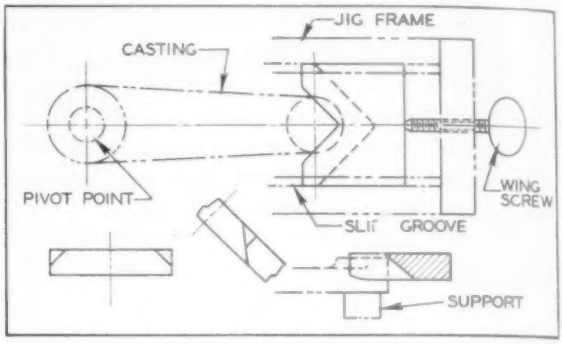
This tool can be substituted for loose parallels, C-clamps and other cumbersome setups, while workpieces of any size from the smallest up to fairly large can be accurately and securely positioned for drilling. Besides the small V-groove immediately under the jaws serve for holding round stock of considerable range for drilling.

Construction is simple, both body (1) and clamp (2) being of welded construction. Both clamp jaws and body may be hardened, with the feet of the latter and the clamping surface ground parallel. Other details include a clamp screw (3), a rocking nut (4), pivot screws (5) and hinge pins (6) and (7). Relieving the latter, as shown in section C-C, provides a slight equalizing for the clamp. Overall length—X—should be about 12 inches, with other dimensions in good proportion.

Carl A. Taylor
North Texas Chapter

Centralizing Slide Plate

The combination centralizing and clamping slide plate, shown, was used for drilling the second hole in the center of a round boss in a casting in which the opposite hole had been drilled in previous operations.



A slider, combining the functions of an equalizer and clamp, locates and clamps the boss of a previously drilled workpiece.

The jig, here partly shown, was made U-shaped, with a pin—slip fit in the previously bored hole—pressed into the bottom plate. The workpieces were slipped onto this pin, then, the slide plate was slid into contact and tightened with a wing screw. The Vee in the slide acts as both centralizer and clamp.

H. J. Malm
Erie, Pa.

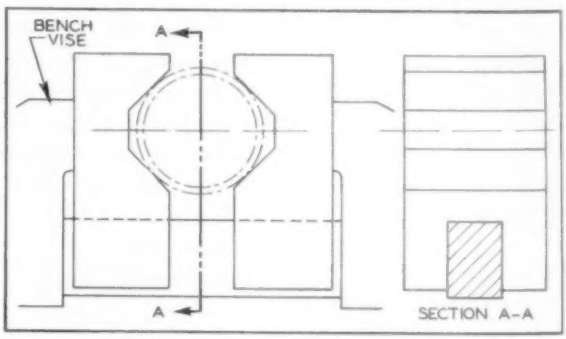
Vise Jaws for Tubing

The auxiliary vise jaws here shown are handy for holding large pipe or tubing. The jaws are loose in the vise, for ready removal when not needed, yet will grip the work accurately and securely.

The jaws, which can be hardened and even checkered if so desired, are machined with Vees to facilitate holding. A slot is milled on the bottom to slip over the square travel bar of the bench vise.

Irving Mansfield
New York, N.Y.

The auxiliary vise jaws shown will grip tubing in a wide range of diameters, the main consideration being to apply clamping pressure proportionate to wall thickness.



Globe Corporation:

Tooling for Targets

By Gilbert P. Muir

A THOROUGH-GOING JOB OF applying tool engineering to a plant with limited production in a specialized industry is the record of Globe Corporation's young Robert H. Wendt. The aircraft division of Globe Corporation is one of the country's largest producers of radio-controlled target planes, used by the armed forces in naval and air gunnery practice.

Target plane production might be very roughly compared to modern aircraft production in miniature. There are far less parts to assemble in a target plane, but on the other hand there few standand-sized aircraft designed to withstand a parachute landing or a salt-water dive as a part of everyday operation.

Globe's aircraft production is directed by Tool Engineer Wendt as vice-president and general manager, operating out of the main plant at Joliet, Ill. Here are centered administration, planning, production control, engineering, sub-contractor liaison and purchasing. Final assembly is performed at Williams Bay, Wisconsin, and additional facilities at Point Mugu, California.

The Company

Although Globe's entry into the target field dates from the early forties, pilotless planes go back to the first world war, including a flying bomb developed by Kettering in 1918.

As the Frankfort Sailplane Company, headed by George F. Getz, Jr., the firm in 1941 produced the first training glider procured by the government. Facilities were expanded the following year to include target production, and this became the company's chief line.

Prior to the mid-forties, targets were of steel tubing, wood-and-fabric construction, as shown on page 52, bottom left. With Bob Wendt's joining Globe in 1945, production was switched to all-metal models, which included initial tooling and production operations. Metalworking facilities were expanded and in many cases initiated, and Globe established the network of suppliers which today provides a smooth-running flow of parts and sub-assemblies from Wendt's "outside production departments."

Tool Engineer Wendt with models of his earliest and latest target designs.

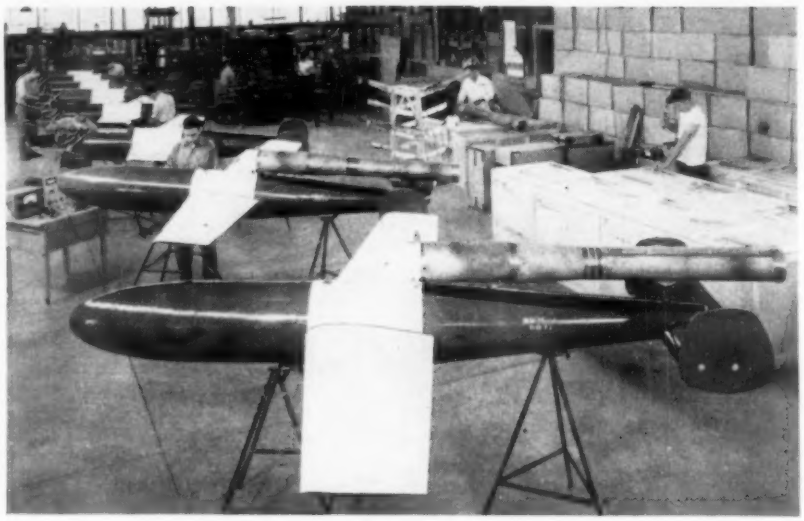
The Man

Tool Engineer Wendt, at thirty-nine has plenty of solid experience to throw into tooling and manufacturing problems. His twenty years in the aircraft industry have included the vice-presidency of Taylorcraft and the presidency of his own personal-plane company.

His approach to Globe's operations has been from the standpoints of product design and good tool engineering. Globe's target designs have been highly successful; their current models have sold the armed forces, and proposed models in both piston engine and jet categories reach a high level of development in speed, design and maneuverability.

Bob Wendt's tool engineering approach to aircraft manufacture is orthodox as far as possible in a field that is completely unorthodox in nature—and it is effective. Two great problems are immediately apparent: a limited volume and a need for considerably more than average flexibility of operation.

The aircraft industry—and this includes targets—is well known for its extremes of output. This type of half-to-fullscale manufacturing is not conducive to steady scheduling, nor is it practical to attempt it with most of your capacity under your own roof. Obviously it means carrying a heavy burden when produc-



Assembly of Globe Corporation's targets is on a straight-line basis, with incoming assemblies channeled to meet progressive assembly.

tion is light (or reducing the burden and knifing community relations in the back). In addition, it does not have the acceleration necessary when orders, and therefore production, jumps several hundred percent overnight.

As a result, Tool Engineer Wendt has developed the supplier approach to a high degree of accuracy, dependability and flexibility. Globe's suppliers absorb the impact of a heavy production increase with a comparably smaller amount of trouble, as part of an overall plan which goes considerably farther than the usual manufacturer-supplier relationship.

A high percentage of Bob Wendt's manufacturing operations are carried on outside his plants, therefore scheduling and follow-up are vital activities. Inspection is also a greater problem than usual, since his target components must meet aircraft-quality standards and armed-forces inspection in his own plant.

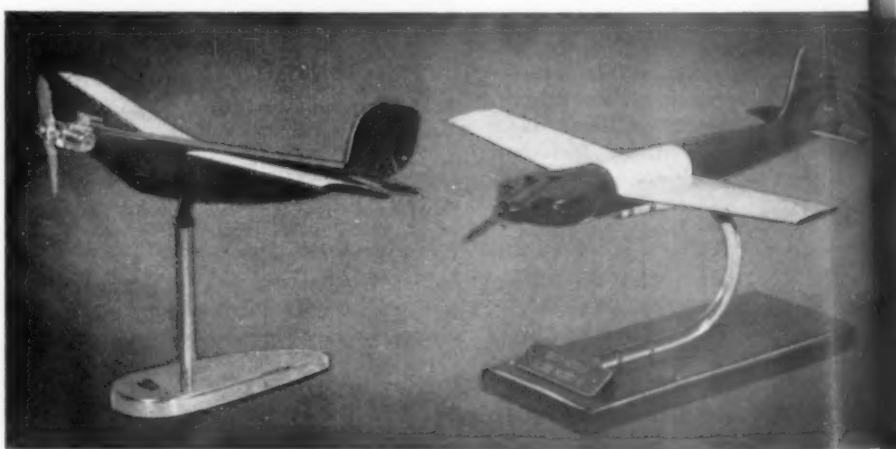
Planning

The cycle which a new model completes before going into production ties in with its planning and production control phases. It runs about as follows:

1. Completion of drawings, engineering and final development work.
2. Construction of mock-up of model.
3. Construction of flying mock-up. In this phase of the cycle, those participating include production representatives, planning members, inspection, and armed forces representatives.

   At this time an informal mock-up board goes over all aspects of the design. The board includes operating personnel from all Globe's plants, in addition to representatives from the services.
4. A contract is let by the service branch for an "evaluation quantity", which represents a pilot-plant operation for that model. This initial production quantity is then tested by the services under actual operating conditions.
5. Revisions or changes are then incorporated into the final model. Production prototypes are made of this model and subjected to further tests.
6. Tooling and manufacturing plans are completed, and the target goes into production.

Overall organization of the Globe operation is illustrated by the chart shown at top of page 54. Under Vice-President Wendt, all Globe plants are correlated into the complete team. Chief Engineer C. N. Lusty heads Globe engineering and engineering contract work, as well as security on engineering and production activities.



The design history of Globe's targets is shown in the panels at right. At far left is earliest fabric-covered target; designs progress to latest jet and piston designs at right.

Under Plant Superintendent P. C. Gow is the nerve center of production and supplier follow-up, the production control group, who work with specially-assigned project engineers under the chief engineer in carrying out an order.

Engineering

Globe's engineering department serves a dual function in that an important part of its work is directed toward contract engineering and development on target designs, etc. Such work never reaches production in its initial contracted-for from, and thus forms the basis of the double positioning in the operations chart shown in the lower part of page 54.

Production Control

The operations chart referred to above outlines the production control system at Globe in its broad phase. Heading the chart is the Contracts and Administration panel, which is an operating group made up of personnel from production, engineering and production control, and is directed by R. H. Wendt.

Under master scheduling, a functional operation, production and engineering are set up for their joint and separate phases of operation. Where the project is a manufactured assembly, the two groups tie in to production control, where engineering, as mentioned above, maintains liaison with the assignment of a project engineer to the specific job or contract.

Purchasing in this set-up has a follow-up function which is related to production control, and which aids in the scheduling and follow-up of suppliers. Working with the purchasing group are follow-up supervisors or expediters who maintain a constant check on suppliers' operations.

As a part of Globe's "outside production department" plan, supplier contact assumes an integral function which varies with the nature of the part and the supplier's record as reflected by deliveries, inspection records, length of association and management of the supplier's plant. Bob Wendt has instituted, in addition to a progressive intelligence system, a supplier-aid plan which ranges from consultation on die design or production problems to direct aid at the top in the form of management counsel.

Not necessarily in chronological order here is inspection, which is maintained at three stages in some cases: source inspection, receiving inspection and periodic in-plant and in-process inspection by armed forces and company inspectors. With aircraft-quality specifications, this involves Magnaflux and X-ray inspections on frame parts and welded members, using statistical and, in some cases, 100 percent inspection.

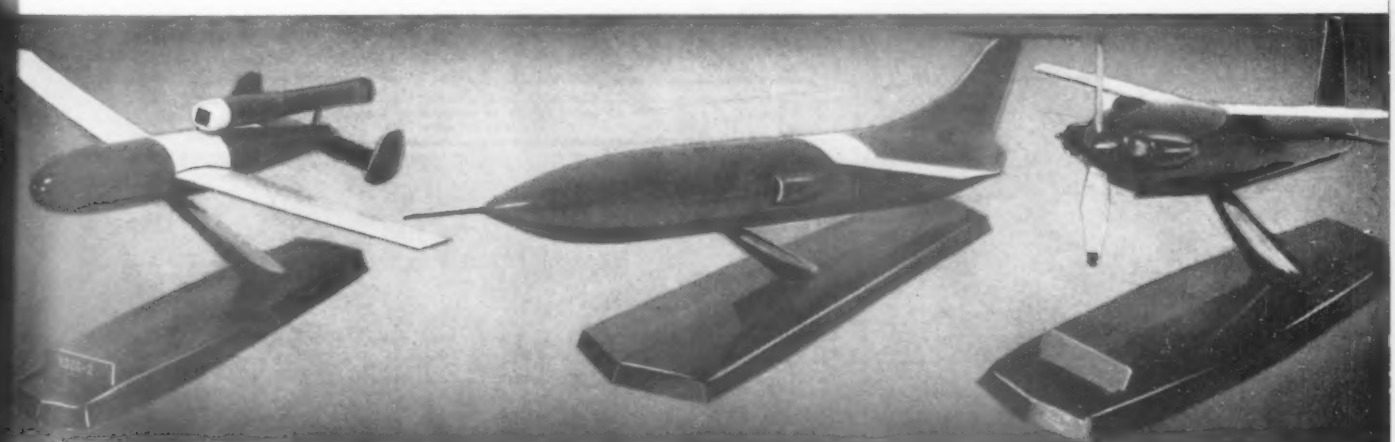
The Product and Its Manufacture

Globe's target production is concentrated on both piston and jet engine types, with advanced models of both in the works. There are technical advantages in each design, of course, and in general they fall somewhat along the following lines:

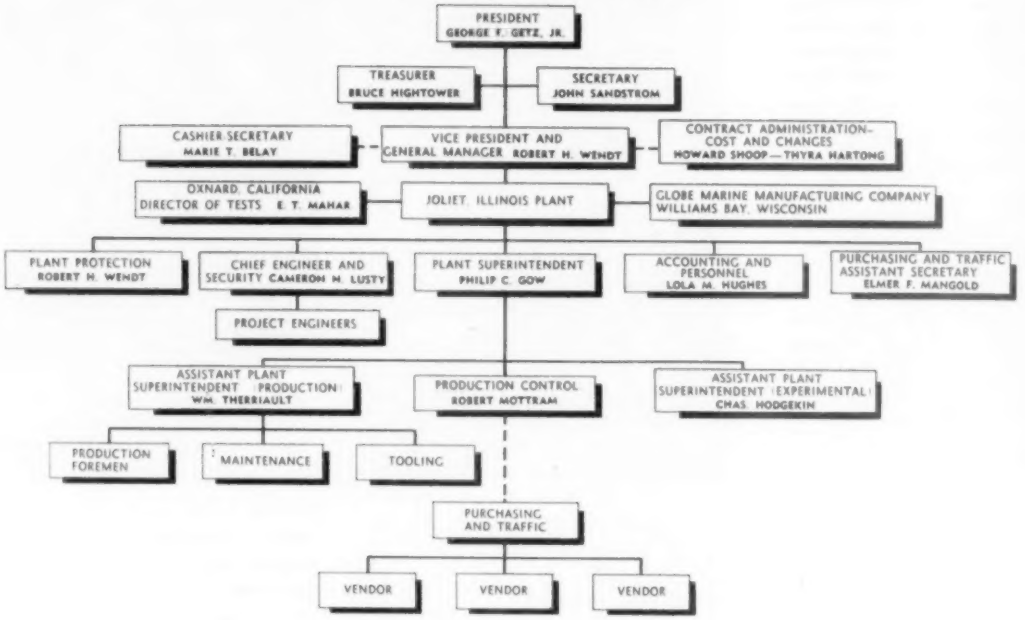
Fitting and alignment of interlocking wing sections is accomplished in this clamping fixture.

Jet: Simplicity of design and low construction cost are two advantages of the stainless steel pulse jet engine, in addition to much greater speeds. Maintenance is lower, which is significant, since the pulse jet model can be dropped into the sea and requires only a fresh-water rinse to stave off corrosion. The jet model also offers the nearest simulation to an actual missile.

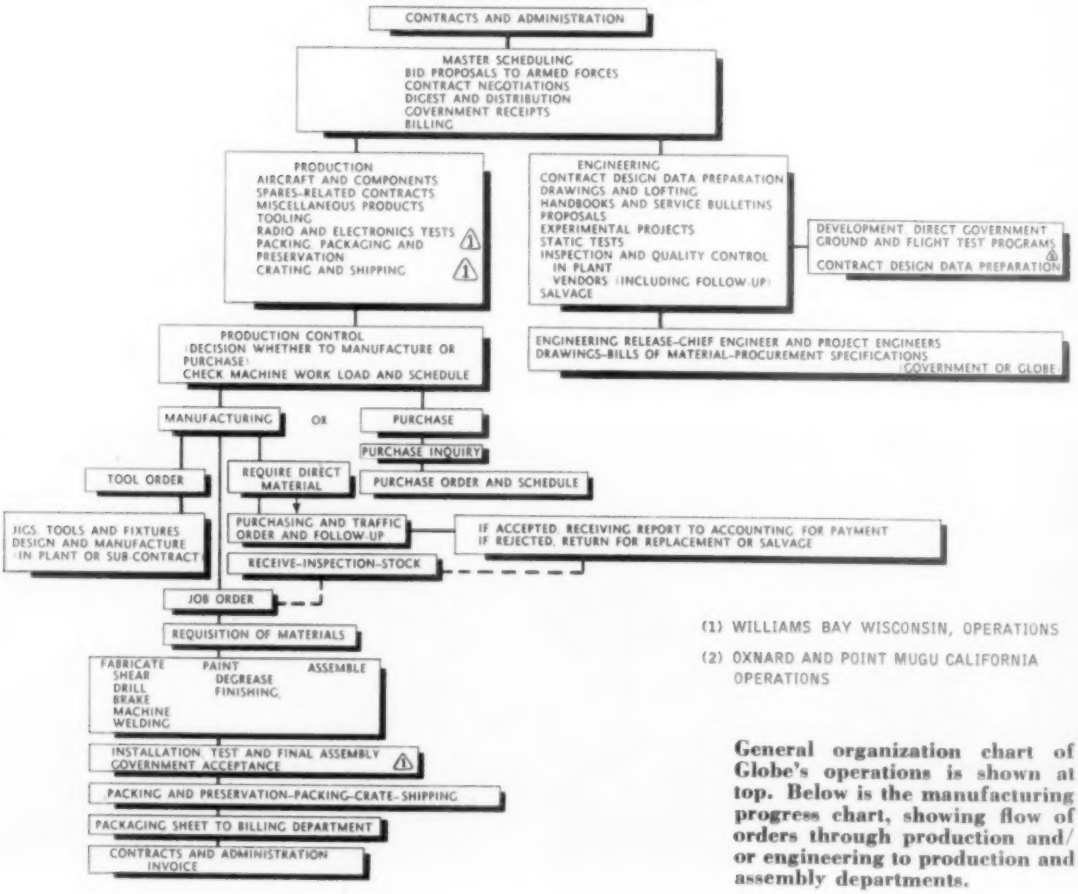
Piston: Expressed rather in the form of the negative aspects of the jet engine are its high fuel consumption and the problem of personnel adaption to the comparatively new type of engine and its characteristics.



General Organization



Manufacturing Progress Chart



(1) WILLIAMS BAY WISCONSIN, OPERATIONS

(2) OXNARD AND POINT MUGU CALIFORNIA OPERATIONS

General organization chart of Globe's operations is shown at top. Below is the manufacturing progress chart, showing flow of orders through production and/or engineering to production and assembly departments.

The recovery requirement extends also to the components of the target —no small problem in view of the delicate electronic receiver, gyroservos and controls which make up the heart and brain of the mechanism. In addition, the target has no landing gear provision, which means that a parachute drop on land (equivalent to a free fall of about eight feet) is considered normal, and must be designed for without adding to production problems.

The subassemblies which make up the pulse jet target are shown on this page. The engine, shown at bottom left, is made up of three welded sections of type 304 stainless, which adds to heat and corrosion resistance. The front hub, an aluminum drawing, encloses the grid shown at left of the engine which serves as an air valve in supplying intermittent blasts of air to the combustion area of the engine.

Simplicity and low replacement cost are features of the target nose cowl, which is a single spun component of 3S-0 aluminum.

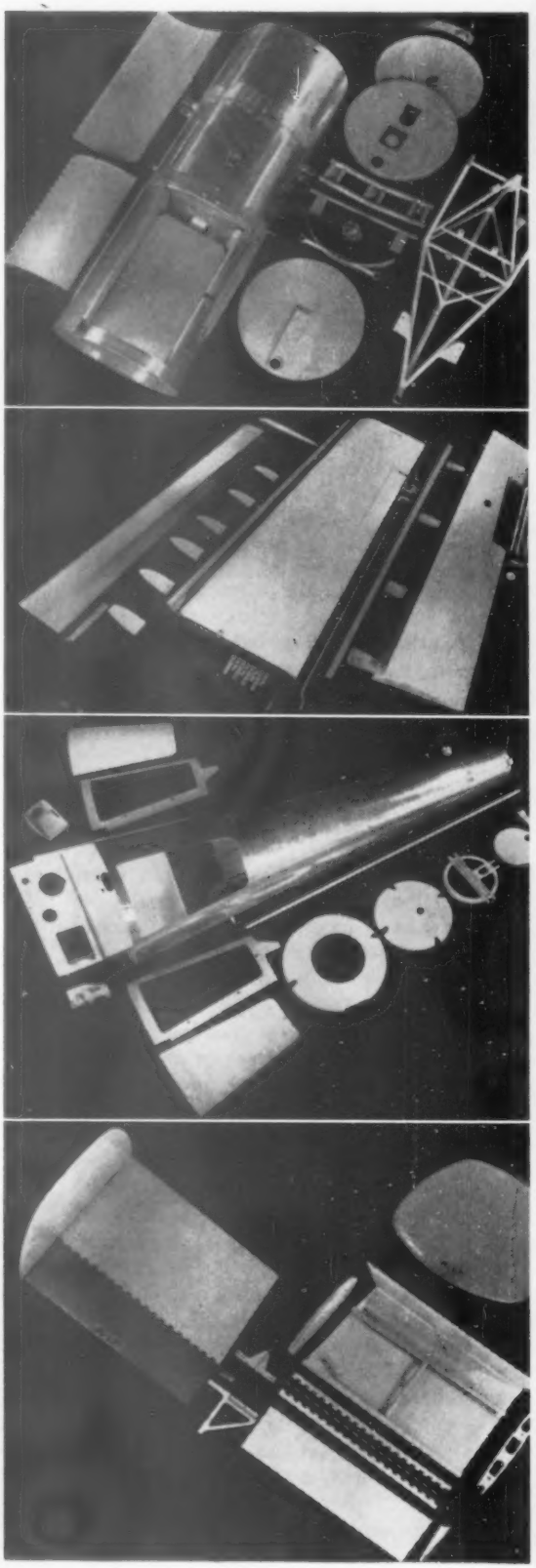
The tank and nose section of the fuselage, shown at top right, is an all-metal assembly which houses the parachute and fuel tank. Skin is spot and seam welded around internal sections shown at center of the photograph, and all operations are subject to rigid inspection, including physical destructive tests made at various periods throughout the day on all welds.

Each wing of the target is made up of a closely-fitted leading and training subassembly, which is fitted in an accurately-controlled clamping fixture and blind riveted together. Push-pull rods connected to a gyroservo in the fuselage control the ailerons.

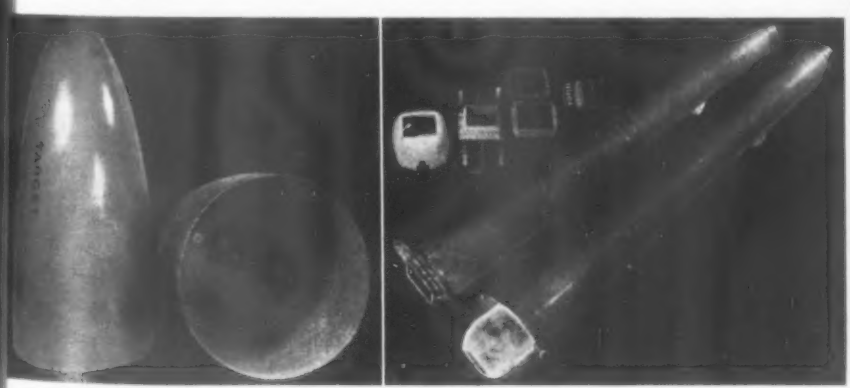
The fuselage aft section, like the main fuselage component, is designed as a simple joined assembly and with a mechanical linkage between it and the empennage, or tail section, which is shown beneath it. Assembly of the entire fuselage and its projections provides for a simple replacement of any component.

The Final Analysis

Good tooling and production planning in this operation go along with good product design. The success of Tool Engineer Wendt's efforts lies in the adaptation of design, management, tool engineering and production principles to an unusual application, and correlating these various activities so that the advantages of each is realized in the others. A one-customer situation requires special tooling on the management and organization ends of the operation, and the controls shown here can well form a part of the planning of other manufacturers contemplating a similar operating picture in the near future.



At right and below are shown some of the components and subassemblies which go into the Globe jet target. At left below is the jet engine showing its grid and air-valve components; at right is the spun aluminum nose which forms the front section of the fuselage. Top right photo shows mid-section assembly, with wing assembly beneath. Aft fuselage section is third from top, and tail assembly is at bottom.



Proposals to Amend Constitution up for Membership Vote

April Ballots List Research Fund Legislation, Lowered Age for Seniors, Changes in Junior and Student Qualifications, Corrections, Clarification

IF THE MEMBERSHIP follows the voting trend (at press time) of chapter constitution and by-laws committees, the ASTE Research Fund will be segregated from Society property; its direction will be by an autonomous committee and for the purpose of advancing scientific knowledge in tool engineering and the educational facilities to disseminate it.

Requires New Legislation

But a proposal to lower the minimum age for Senior Membership from 25 to 21 years is being turned down by a slight majority.

These actions are on four of 11 constitutional amendments up for processing on the chapter level.

Legal aspects of the Research Fund and the protection of its contributors necessitate incorporating three amendments in the Constitution, if the undertaking is to be approved.

The remaining seven amendments, also petitioned from time to time by the required 75 or more voting members, are miscellaneous provisions to correct errors, eliminate duplication or ambiguity, and settle a long-standing controversy over age limits and requirements for Student and Junior Membership.

These include changes originating with the National Constitution and By-Laws Committee in its overhauling of the Society's legal structure. The proposals have been accumulating until it should become economically feasible and legally urgent to process them.

On February 1 D. R. Linch of Los Angeles, national constitution and by-laws chairman, and his committeemen, Edward J. Berry of Providence, R.I., and Edward H. Ruder of St. Louis, issued ballots to chapter constitution and by-laws committees. After the 30 days' voting period permitted under the Constitution, all approved amendments are to be prepared for submission to the membership this month.

D. R. Linch (right), national constitution and by-laws chairman, and Edward J. Berry of his committee, work at headquarters in Detroit preparing petitioned amendments to Society law for processing through chapter constitution and by-laws committees and the membership.

Following are existing provisions concerned, proposed changes and explanations thereof:

Present Provision (Division 1, page 3, lines 25 through 30):

The Board of Directors shall have complete charge and control of the entire property of the Society, and its decision in matters relative to such property shall be final. The general management of the affairs of the Society shall be within the jurisdiction of the board of directors.

Amendment A (Division 1, page 3, line 28) After word "final" and before word "the," add:

Any monies contributed to the American Society of Tool Engineers' Research Fund, either by the American Society of Tool Engineers or by any other source, shall not be included as part of the property of the American Society of Tool Engineers.

Present Provision (Division 1, page 4, lines 36 through 81—appointment by the President, setup and operation of administrative committees.)

Amendment B (Division 1, page 4) Between lines 64 and 65, insert the following paragraphs:

A Research Fund Committee, composed of not less than five, nor more than fifteen members, shall be charged with the duty of and have the sole authority to administer, receive, and disburse all funds available in the American Society of Tool Engineers' Research Fund, and to direct and regulate all research activities, according to the provisions of the Constitution of the American Society of Tool Engineers.

The members of the Research Fund Committee shall be elected by the Board of Directors.

The Chairman or members of the Research Fund Committee may be removed from office by the Board of Directors, but only for malfeasance, misfeasance or non-feasance in office.

Elected by Board

The Chairman of the Research Fund Committee shall be elected annually by the Board of Directors from the membership of the American Society of Tool Engineers' Research Fund Committee, and the Board of Directors may also elect one additional member of the Committee each year until the maximum committee membership shall be attained, and thereafter only to fill vacancies.

In the event of a vacancy in the Chairmanship of the American Society of Tool Engineers' Research Fund Committee, the Board of Directors shall appoint a Chairman Pro-Tem from the remaining members of the Committee to serve out the unexpired term.

Present Provision (Division 1, page 5, lines 17 through 37—publications and standards policies)

Amendment C (Division 1, page 5) After line 23 and before line 24, insert:

RESEARCH

There shall be and hereby is created a Research Fund for the purpose of conducting research for the advancement of scientific knowledge in the field of Tool Engineering, and the development of educational facilities for the dissemination of such knowledge, in such man-

ner as will promote the general prosperity, welfare, and security of the United States. Monies may be contributed to such fund by the Society at the discretion of the Board of Directors, and contributions thereto may be solicited from available sources. Such funds when so contributed thereto shall be held for the purposes expressed herein, and shall be used and disbursed for such purposes, and none other. Such funds shall be under the control of, and administered only by the American Society of Tool Engineers' Research Fund Committee, and shall be kept in a suitable depository in the name of such fund, and withdrawn and disbursed only for the purposes expressed herein.

Approved by Board, Legal Aid

Explanation: Amendments A, B and C are proposed to be set up in the Constitution to give validity to the American Society of Tool Engineers' Research Fund and to the operations of the Research Fund Committee. This research program has been approved by the Board of Directors and by the legal counsel of the Society. It is felt that contributions to this fund will be made by industry-at-large.

Present Provision (Division 1, page 1, lines 69 through 71):

Before a person may become a Senior Member, he must have attained the age of twenty-five years.

Amendment D (Division 1, page 1, line 70) Change: "twenty-five" to read "twenty-one."

Explanation: If it is the desire of the ASTE membership to lower the age limit on Senior Members, it is felt that it should not be lowered below 21 as that might permit a minor (who is not legally responsible) to hold office in the Society.

Clarifies Senior Privileges

Amendment E (Division 1, page 1, line 71) After word "years" add:

Senior Membership shall carry voting and ownership rights.

Explanation: For positive clarification.

Present Provision (Division 1, page 1, lines 72 through 80):

An applicant who complies with any of the foregoing qualifications but with less than five years' experience in said fields is eligible for Junior Membership. Any student in a recognized school or college studying tool engineering or related engineering, or, in a related established apprentice training system is eligible for Junior Membership.

Before a person may become a Junior Member, he must have attained the age of twenty years.

Amendment F (Division 1, page 1, line 75) After word "membership," delete remainder of paragraph through to end of line 78. Then add:

Junior membership shall carry voting and ownership rights.

Explanation: Student Membership is provided for in another section. Added portion is for clarification.

Present Provision: (Division 1, page 2, lines 11 through 17):

Eliminates Age Limit

Any student less than twenty years old, in a recognized school or college studying tool engineering or related engineering, or, in a related established apprentice training system is eligible for Student Membership. No voting or ownership rights shall be allowed with this grade of membership.

Amendment G (Division 1, page 2, line 11) Delete words "less than twenty years old."

Explanation: To provide for students older than twenty years, but lacking qualifications for Junior or Senior Membership.

Present Provision: (Division 1, page 2, lines 66 through 68):

Past Presidents of the Society shall be admitted to Life Membership at the end of their year of service as President.

Amendment H (Division 1, page 2, line 67) Change word "year" to read "term."

Explanation: To cover possible reelection of a President.

To Prevent Downgrading

Present Provision (Division 1, page 2, lines 69 through 73):

Whenever a member of one grade of membership shall desire to be transferred to another grade, he shall make application in writing to the Board of Directors for such transfer, giving qualifications which entitle him to transfer.

Amendment I (Division 1, page 2, lines 69 through 73) Delete entire paragraph and, in its place, substitute:

All members must be graded in the highest grade to which they are qualified.

Explanation: The purpose of this amendment is to prevent a member from being classified in a grade that would permit him to avoid payment of higher dues.

Present Provision (Division 1, page 3, line 93 through page 4, line 4):

The Board of Directors shall, at the annual directors' meeting, elect a President, Secretary, Treasurer, and may also elect one or more Vice-Presidents, Assistant Secretaries and Assistant Treasurers. To be eligible for election to these offices, a member must, at the time of election, be a Senior Member who has been in good standing for at least one year.

Amendment J (Division 1, page 3, line 95) After "President" and before "Secretary," insert "First Vice-President."

Explanation: To provide against a vacancy in the office of President. (Division 1, page 4, lines 32 through 34, stipulate: "In the case of a vacancy in the office of President, the ranking Vice-President shall serve as President for the unexpired term.")

Present Provision (Division 1, page 5, lines 47 through 57):

. . . Notice of the proposed amendment, giving complete information as to the reasons for the amendment, and an explanation of its purpose, shall be sent to the Chairmen of the Constitution and By-Laws Committees of all Chapters, which Committees shall within thirty days approve or disapprove the amendment as submitted. If a majority of the Committee signifies approval, a ballot shall be mailed to each member entitled to vote within thirty days after the date upon which the approval has been received. . .

Amendment K (Division 1, page 5, line 55) Change: "Committee signifies" to read "Committees signify."

Explanation: To correct a clerical error.

With the exception of Amendment D, all the changes, additions and deletions have been approved by most of the voting chapters.

When members receive their ballots, National Chairman Linch urges, they should give careful consideration to the proposed legislation and make a thorough study of the context in the Constitution, before voting.

Other News In This Issue

Chapter listings include member as well as meeting news.

Canadian Chapters Set Up Regional Meeting Procedure

Toronto, Ont.—In an all-day regional conference, representatives of five Canadian chapters established a permanent procedure for such meetings. The get-together was held February 17 at the office of Canadian Fairbanks-Morse Co., Ltd., Toronto.

According to the plan worked out for approval of the chapters concerned, delegates are to submit expense accounts to Toronto chapter for reimbursement. Toronto in turn will invoice the delegate's home chapter equably in proportion to its size and the cost of the meeting.

To Be Held Semi-Annually

Future meetings are to be held at a central point the third Saturdays of February and September unless otherwise specified.

Participants were: Jean B. Cloutier, Fred W. Dunn, Douglas R. Cooper, J. E. R. Yorick, and Harold J. A. Chambers, chairmen-elect of Montreal, Niagara District, Toronto, Hamilton, and Windsor chapters, respectively; Clifford G. Bradford, John B. Burk and George H. Churchill, chairmen of Niagara District, Toronto, and Hamilton chapters, and Allan R. Putnam of national headquarters office, Detroit. Grand River Valley chapter was not represented.

In the absence of R. Eric Crawford, Toronto past chairman, detained by family illness, Mr. Cooper was asked to take the chair.

Membership was one of the major topics discussed. The officers exchanged experiences in building membership and recommended that national headquarters clarify definitions of membership qualifications. Also on the agenda were ways and means of financing chapter activities.

Members from the attending chapters were appointed to be responsible for an interchange of programs and meeting reports. They are: J. B. Cloutier, 5035 Ontario E., Montreal, Que.; David Heath, c/o Ford Motor Co. of Canada, Ltd., Windsor, Ont.; L. W. Dunn, c/o Thompson Products, Ltd., St. Catharines, Ont.; D. R. Cooper, c/o Canadian Fairbanks-Morse Co., Ltd., 137 Harbour St., Toronto, Ont., and J. E. R. Yorick, 105 Sterling St., Hamilton, Ont.

Other matters discussed included a listing of all Canadian chapter meetings on each chapter's meeting announcements, and the presentation of the chairman's merit award to members who have rendered outstanding service to a chapter.

As national office representative, Mr. Putnam was asked to explain various headquarters operations, including the change in *Tool Engineer* format and the routine for handling chapter news.

Detroit Announces Student Awards

Detroit, Mich—Two student awards of $350-$500 each have been established by Detroit chapter, according to an announcement by Stanley C. Phillips, education chairman.

The awards may take the form of scholarships or fellowships or a combination of the two. They will be confined to accredited institutions in Michigan, preferably in the Detroit metropolitan area. The first grants are to be made in July.

Eligibility requirements will be listed in a forthcoming booklet. Detailed information may be obtained from Mr. Phillips at Wilbur Wright School, 4333 Twelfth St., Detroit 8.

Brandvik Transferred

Chicago, Ill.—Harry Brandvik of Chicago chapter will be in charge of the new district office opened by Kennametal, Inc. in the Metropolitan Building, Minneapolis, Minn.

Mr. Brandvik was formerly a service engineer for Kennametal in the midwestern district.

Hamilton members exchange opinions on forging samples displayed by R. G. Freidman of National Machinery Co. after his talk on forging.

Improved Forging Methods Said to Extend Die Life

Hamilton, Ont.—The spectacle of red hot metal going places in a hurry was brought to Hamilton members through the medium of a color film presented at their January dinner meeting by R. G. Freidman, vice-president in charge of engineering at National Machinery Co., Tiffin, Ohio.

The motion picture showed "in operation" action of this company's presses and demonstrated cost-saving possibilities of its Reduceroll machine.

The engineers were particularly impressed with the extravagant change of shape from a standard billet to a forged product at the end of a run, often completed in one heat.

Uses Unconventional Methods

Contrary to usual forging practice, presses were speeded up, sometimes stroking faster than conventional piercing and blanking presses of the stamping industry. Slow motion shots showed the effectiveness of this action. During extrusion operations the displaced metal flowed up the punch like so much hot taffy. There was no distortion or bulging of the parallel sides.

An increase in the number of parts off between recuts and improved die life of from two to five times over conventional forging methods are claimed for this process.

The door prize, an ASTE handbook donated by Rudel Machinery Co., sponsor of the program, was awarded to David Roland.

Before the meeting closed a Nominating Committee was elected. Its members are George Gilmour, Sidney Dunn and Clarence Bulmer.

GALT, ONT.—Mr. Freidman also presented this program at an earlier meeting of Grand River Valley chapter.

After his talk and film presentation he displayed intricate parts manufactured by the machines described, and answered questions from an interested audience.

A social hour and buffet luncheon followed the technical session.

Ford Appoints Morrissey

Dearborn, Mich.—Appointment of Ray Morrissey as manager of manufacturing engineering, Engine and Foundry Div., Ford Motor Co., has been announced by Charles H. Patterson, general manager.

Since joining the Ford organization early last year, Mr. Morrissey has been on special assignment with the production manager's office, automotive manufacturing operations. Prior to this the Detroit ASTE member had been vice-president of The Cross Co.

Greater New York chapter elected as officers for the coming year, from left: Joseph P. Schneider, chairman; Hugo Aglietti, second vice-chairman; Virginia Martino, secretary; John Dokulil, treasurer; and Edward Galvin, first vice-chairman of the host chapter for the 1951 convention.

New Chapter Officers Chosen in February Elections

New York City—Greater New York chapter advanced three of its officers, re-elected its secretary, and chose a new treasurer to fill the vacancy caused by the promotions, at a meeting held February 5 in Hotel New Yorker.

The new officers are: Joseph P. Schneider, chairman; Edward F. Galvin, first vice-chairman; Hugo Aglietti, second vice-chairman; Virginia Martino, secretary, and John Dokulil, treasurer.

Carl Kertesz, retiring chairman, was named chapter delegate, with Julius Schoen, also a former chairman, as alternate.

All of the newly-elected officers were active on committees for the Society's annual meeting at New York last month.

INDIANAPOLIS, IND.—Seventy-two members of Indianapolis chapter braved subzero weather and slippery traveling to go to the polls, February 1.

Hilkenbach Is Chairman

Officers elected are: Ernest W. Hilkenbach, chairman; Denis F. White, first vice-chairman; George R. Duncan, second vice-chairman; Joe Penn, secretary, and Joseph P. Enright, treasurer.

Delegate is Reinhold F. Krause and alternate, Howard W. Curfman.

The technical topic was "Modern Methods of Gear Manufacture," presented by Ben F. Bregi, executive engineer of National Broach & Machine Co., Detroit, Mich.

Joe Penn, chapter secretary and a member of the National Editorial Committee, spoke briefly on changes in the format of *The Tool Engineer*.

WASHINGTON, D.C.—At the February meeting of Potomac chapter Willis DeBoer addressed the assemblage on "Inspection by Optical Projection." Representing the Engineers Specialties Div., Universal Engraving & Colorplate Co. of Buffalo, N.Y., Mr. DeBoer discussed the use of comparator instruments. His talk, as given before other chapters, has been reported in earlier issues of *The Tool Engineer*.

A color sound film, "Functional Photography in Industry," climaxed the evening's program.

Thomasson Heads Officers

New officers elected for the 1951-52 season are: Boyd E. Thomasson, chairman; William E. Jones, first vice-chairman; Harry T. Richardson, second vice-chairman; Eugene Parsons, secretary, and E. M. Seifert, treasurer.

MILWAUKEE, WIS.—As the result of an election at Milwaukee chapter, February 8, the following officers will head the chapter for the coming year: Walter O. Behrend, chairman; Waldemar E. Klein, first vice-chairman; Eugene J. Anspach, second vice-chairman; Robert Bodendorfer, secretary, and Ralph Breczk, treasurer.

Col. Jack Major, nationally known humorist and a protege of Irvin P. Cobb, was the main speaker. Homespun humor was coupled with down-to-earth seriousness in the Kentucky colonel's presentation, "Taxes—Women—Hogs."

A coffee talk by Virgil Hurless, comptroller of the City of Milwaukee, preceded Colonel Major's talk. Attendance was approximately 125.

ERIE, PA.—"Bonded Rubber Products in Tool Engineering" was the subject discussed by Jack Rebman, product and sales engineer of the Lord Mfg. Co., at Erie chapter's February 9 meeting in the General Electric Community Center. The meeting was arranged by members employed at the Lord plant, under the direction of Edward Gustafson.

Vibrations Disturb Other Machines

The theory of vibration was explained and methods of absorbing it were illustrated. As an example, Mr. Rebman cited, a punch press should be placed in the opposite corner of a room containing a precision grinder. The inherent accuracy of the grinder would be disturbed by vibrations traveling through the concrete floor, unless the machine were properly mounted to absorb them.

The following candidates won office in an election conducted by Matthew Hetzel, Nominating Committee chairman: Robert J. Wilson, chairman, Warren; Joseph T. Halmi, first vice-chairman; Edwin Norgren, second vice-chairman; Harry M. Rudd, treasurer, and Leo Weiner, secretary, all of Erie.

Mr. Hetzel was named delegate to the Erie Engineering Societies Council.

Chairman Stanley S. Sadoski presided at the meeting of 27 members and 23 guests. Among the latter were Robert Robison, Standard Stoker Co.; George Billman, Karl Asplund, Robert Kilpatrick and Warren Smith, all of Lord Mfg. Co.; David Henderson, The Hanafin Co., Pittsburgh, and W. T. Friar and class from Penn State Extension School, Erie.

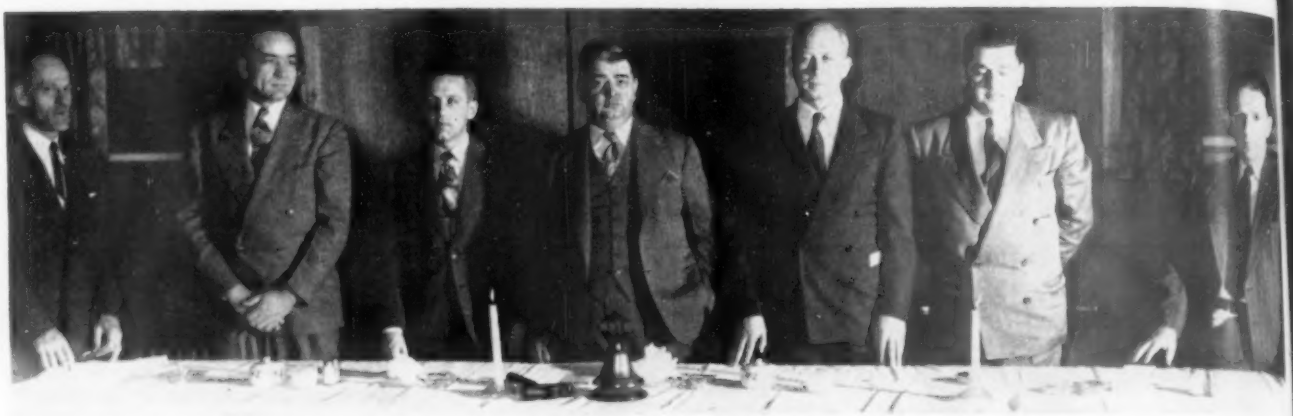
WORCESTER, MASS.—During a well attended dinner meeting at Putnam & Thurston's Restaurant, February 6, Worcester chapter elected officers for the ensuing year.

Baker Wins Top Office

They are: Chairman, Ralph A. Baker, Whitin Machine Works, Whitinsville; first vice-chairman, E. Roland Ljungquist, Lodding Engineering Corp.; second vice-chairman, Bernard D.

Williamsport tool engineers entertain their ladies with a dinner party at Ashurst Manor, Muncy.

(See story in March issue.)



Speakers' table guests at Twin States election night meeting were, from left: W. L. Goldthwaite, Dartmouth College professor, Hanover, N.H.; M. L. Hutchens, Kearney & Trecker Corp. representative, White Plains, N.Y.; Robert Laffin, second vice-chairman; F. J. McArthur, first vice-chairman; A. O. Schmidt (guest speaker) of Kearney & Trecker, Milwaukee; C. Bruce Price, Kearney & Trecker representative, Longmeadow, Mass., and George Julien, chapter secretary.

Szarek, Worcester Pressed Steel Co.; secretary, John E. Rotchford, Lodding, Inc., all of Worcester, and treasurer, John E. Engelsted, Union Twist Drill Co., Athol.

Delegate is Carroll L. Morse, Heald Machine Co., and alternate, Thomas C. Bradford, Anderson Oil Co., both of Worcester.

Fullerton Leads Symposium

The technical session was a carbide symposium conducted by George Fullerton, tool supervisor of Whitin Machine Works. It was devoted to a roundtable discussion of uses and applications of carbide tools and dies.

Speakers taking major parts in the discussion were: Stanley Lovejoy, tool supervisor, and Norman Belcher, carbide coordinator, General Electric Co. River Works, West Lynn; William C. Carr, carbide tool engineer, Heald Machine Co., Worcester; Arthur Hedman, chief die foreman, Wickwire-Spencer Div., Colorado Fuel & Iron Co., Palmer, whose subject was "Use of Carbide Dies," and Mr. Fullerton.

Members of the Worcester Carbide Society were present by invitation. The interest created in this session was evident in a lengthy question period that followed.

ASTE chairman Carroll L. Morse presided at the meeting.

Springfield, Vt.—Dr. A. O. Schmidt, research engineer of Kearney & Trecker Corp., Milwaukee, Wis., addressed the election night meeting of Twin States chapter. Held February 14 at Trade Winds Cafe, the dinner meeting was attended by 60 members and guests.

Dr. Schmidt's subject was "Modern Techniques of Milling." He used slides to point out effects of heat on carbide tools at various feeds and speeds and its direct relation to horsepower consumption of a machine tool.

During a business meeting preceding the technical session, a slate of officers was presented by Lee Davis, Nominating Committee chairman.

The candidates were voted in as follows: Chairman, Floyd J. McArthur of Jones & Lamson Machine Co.; first vice-chairman, Robert W. Laffin of Laffin Supply Co.; second vice-chairman, George Julien of Jones & Lamson; secretary, Edward Duclos of Fellows Gear Shaper Co., and treasurer, Clifford A. Howe of Cone Automatic Machine Co.

St. Louis, Mo.—Members of St. Louis chapter chose Louis W. Greenblatt, president of Greenleaf Mfg. Co., as 1951-52 chairman. The election was held during a dinner meeting, February 1, at Hotel DeSoto.

Other officers named are: Erwin P. Huchzermeier, sales engineer, General Metal Products Co., first vice-chairman; William Bachman, president, Bachman Machine Co., second vice-chairman; William Von Weise, president, St. Louis Gear Co., secretary, and John Ford, president, Ford Steel Co., treasurer.

Stempfle Elected Delegate

Emil Stempfle, assistant factory manager of Carter Carburetor Corp., was named delegate, and Mr. Greenblatt, alternate. Mr. Stempfle is the retiring chairman.

The technical session was conducted by Roger F. Waindle, general manager of Industrial Products Div., Elgin National Watch Co., Aurora, Ill. and third vice-president of the Society.

His subject, "Surface Finishing—The What, Why and How," was illustrated with slides. Emphasis was on machine parts, tools, dies and molds. An analysis of finishes and their measurement, and advantages of higher finishes were discussed, along with methods.

St. Charles, Ill.—On February 6 Stanley R. Cope, president of the Acme School of Die Design Engineering, filled the main dining room of the Baker Hotel with an audience of 105 members and guests of Fox River Valley chapter.

Mr. Cope's subject was "Deep Drawing of Stainless Steel, Nickel and High-Nickel Alloys." Slides accompanying this lecture clearly illustrated interesting and unique processes. Samples of drawn parts were exhibited.

New officers and a delegate to the 19th annual meeting were elected. The officers-elect are: George Bodi, chairman; George R. Parsons, first vice-chairman; Philip C. Shaner, second vice-chairman; Charles A. Olson, secretary, and Donald Zierk, treasurer.

G. M. Waller, present chapter chairman, was elected delegate, and C. A. Olson, chapter secretary, alternate.

Fond du Lac, Wis.—Charles Billberg of Oshkosh was elected chairman of Fond du Lac chapter at a meeting held February 9 at Bernward Hall. Forty-nine members and their 43 guests attended the annual meeting honoring past chairmen. All former chapter heads were present except K. F. Gallimore.

Other officers chosen were: Erwin J. Kaiser, first vice-chairman; Roger E. Kahlenberg, second vice-chairman; John O. Bahr, secretary, and Paul V. Rohling, treasurer.

Names Leadership Qualities

W. E. Rutz, executive vice-president and works manager of Giddings & Lewis Machine Tool Co., addressed the group on the subject, "The Supervisor as a Leader."

Understanding of workers and their problems, orderliness, physical and nervous energy, cooperation, teaching ability, courage, friendliness and honesty, technical ability, cost and budget mindedness were listed by Mr. Rutz as qualities necessary to becoming a manager and leader.

Officers of St. Louis chapters of ASTE and ASM visit at joint meeting of two societies. From left: William Bachman, ASTE treasurer; Harold Oberle, ASTE secretary; Verne Pulsifer, ASM vice-chairman; Emil Stempfle, ASTE chairman; George A. Sands (speaker) of Electro Metallurgical Div., Union Carbide and Carbon Corp.; Carl W. Messinger, ASM chairman, and Erwin Huchzermeier, ASTE second vice-chairman.

Rochester Groups Told How to Prepare for Attack

Rochester, N. Y.—A whistle blast and the glare of a photoflash bulb in a darkened auditorium simulated the impression of an atomic bomb explosion for some 200 members and guests of the Rochester ASTE chapter and the Superintendents and Production Managers Group of the Industrial Management Council.

H. E. Linsley, associate editor of *American Machinist*, made this demonstration during a talk on Disaster Control before a joint annual dinner meeting of the two groups, January 15, at the Rochester Chamber of Commerce.

In emphasizing the importance of Rochester industries to the rearmament program, Mr. Linsley pointed out their vulnerability to atomic attack.

Even without air warfare, he said, destructive fires could be started by saboteurs or carelessness. As preparedness measures the speaker advocated: Inventory fire fighting equipment. Determine whether it is adequate, properly located and in good working order.

Train Safety Squads

Set up training programs to instruct regular and auxiliary safety squads to cope with emergencies. These squads should learn to use fire apparatus and know the proper extinguishing agent for each type of fire. Cooperate with neighboring plants by exchanging inventories of such equipment for emergency use. Hold fire drills.

Keep records in fireproof vaults or have them microfilmed for easy reproduction. Bring personnel files up to date with information on job interchangeability or replacement in case key operators are killed during a disaster or air raid. Isolate stocks of inflammable fluids.

Weed out saboteurs. They may be detected by broken tools, damaged machinery, excessive scrap, slow-downs in production, improper gages that may cause unnecessary rejections. Watch for agitators who stir up trouble.

A film, "You Can Beat the 'A' Bomb," climaxed Mr. Linsley's presentation. The speaker recommended that this motion picture be shown in plants for its educational value.

He closed his talk with a striking example of what cooperation can do. In the again darkened hall his cigarette lighter made a feeble glow. But when the audience made the experiment the increase in candlepower was tremendous.

James O. Horne, first vice-chairman, introduced the speaker and thanked him for his talk.

Key Service Executives Present

Chairman Tucker of the IMC opened the meeting, welcomed the combined groups and introduced speakers' table guests, including Chief Murray of the Rochester Fire Department and Samuel Alling of the Rochester Gas and Electric Co.

Mr. Tucker next presented Emmett Moore, ASTE chairman, who commented on the success of past joint meetings. Mr. Moore asked for candidates for a committee to nominate chapter officers. William Gordon, Chauncey Newton and Herbert Simon, all former chairmen, were elected.

William Kamola, education chairman, reviewed the history of the chapter's annual award to the most deserving student in the tool engineering course at the Rochester Institute of Technology. He presented this year's scholarship to John Ash, Jr., chosen for his excellent record at the institute.

St. Louis, Mo.—Approximately 225 members of the St. Louis ASTE and ASM chapters met January 11 at the DeSoto Hotel.

George A. Sands, assistant manager of development in the Electro Metallurgical Div., Union Carbide and Carbon Corp., was the technical speaker.

Mr. Sands opened his talk, "Corrosion Resistance of Stainless Steel as Affected by Various Fabricating Processes," by defining stainless steels as alloys of iron with 12 or more percent of chromium.

In fabricating stainless, he said, severe cold work will decrease corrosion resistance, where extreme corrosion is likely to occur. Stress corrosion cracking occurs only on metal surfaces in tension. In most cases it is tied in with pitting or the reducing type of corrosion usually caused by a member of the halogen group.

During an open discussion period a question was raised as to why the industry should have trouble obtaining the extra-low-carbon grades of stainless. Mr. Sands was unable to answer this question, but expressed the opinion that titanium stabilized grades should be available since that metal does not appear to be in short supply.

He recommended prior and post heating in welding straight chromium grades to avoid brittleness.

An Allegheny Ludlum Steel Corp. film, "Stainless Steels," completed the program. The picture showed the production of stainless from melting to finished forms.

James O. Horne (left), first vice-chairman of Rochester chapter, congratulates H. E. Linsley of *American Machinist* on his talk on Disaster Control. At right is Emmett Moore, chapter chairman.

Elmira, N. Y.—On February 12 Elmira chapter held another of its joint meetings with ASM, at Hotel Langwell.

Ninety members and guests of the two organizations were present to hear Paul Payson of the Crucible Steel Co. of America, Harrison, N. J. Mr. Payson spoke on "Fundamentals of Heat Treatment."

After Mr. Payson's talk the ASTE group elected Henry G. Lemaire of Eclipse Machine Div., Bendix Aviation Corp. as chairman for 1951-52. Other officers selected are: First vice-chairman, Francis T. Dubuque, Remington Rand Co.; second vice-chairman, Edwin C. Bates, National Acme Co.; secretary, Edward P. Ballard, and treasurer, Charles F. Roe, both of Eclipse Machine Div.; delegate, Mads H. Kristensen, Corning Glass Works, and alternate, Patrick Pecoraro, also of Eclipse.

Los Angeles, Calif.—Long Beach

chapter visited the Los Angeles tool engineers January 11 for a joint meeting at Scully's Cafe.

Harold E. Collins, ASTE second vice-president, related his observations and experiences during a five months' business trip to Europe. He described devastation still apparent in war-damaged countries, and commended the European industrial machines and workmanship.

Our Society

By H. E. Conrad

To meet the printer's deadline, it is necessary to write this message before leaving for our 19th annual convention at New York. So I can't give a firsthand account of what happened at the meeting. All indications now point to one of the best conventions we've ever staged.

Preprints of the technical papers have been prepared. If you missed the meeting, look over the list and order those that interest you. The complete set will prove valuable to all tool engineers. These discussions give the latest information on current tooling topics.

If you start with the collection of 32 papers and add talks presented at subsequent national meetings, you can develop a file of technical literature not available from any other source.

Administration Needs Your Help

As you read this we are beginning another ASTE year—new officers, new committeemen—all starting out hoping to do a topflight job. While the future seems to hold a heavy work schedule for us all, every member should cooperate with our new officers.

Instead of putting the load on a few shoulders, it will be necessary to divide the work among many. Your willingness to stand by for any assistance possible will be appreciated.

With intensified activity in the field of tool engineering, the Society has a challenge to keep abreast of the need and to service its members. Chapters should seize the opportunity for expansion, work diligently to get new members. New industrial areas will open up. New chapters will be needed. We must all be alert to every potential. By working as an harmonious unit for the next few years, we can go far.

Your national officers will provide outstanding leadership. And they are counting heavily on your help. We have the incentive, we can see the goal, we know the problem. So let's all pull together and hang up a new record this year.

L. R. McAfee (left), acting first vice-chairman of Dayton chapter, asks Dr. Edward Orban, Monsanto Chemical Co. physicist, about industrial applications of atomic energy.

Evansville Dinner Party Honors ASTE Ladies

Evansville, Ind.—Technical subjects were shelved by Evansville chapter while the tool engineers entertained their ladies, January 8, at the Alpine House. About 62 members and guests attended the annual dinner function.

As emcee, Vernon Ashby, industrial relations director for the Ideal Pure Milk Co., led group singing and conducted various contests and stunts to entertain the group.

J. L. Cooperider, science department head at Central High School, narrated a series of color slides depicting autumn in Indiana, native and exotic flowers. Included in the collection were prize winning color shots exhibited in salons around the country.

After several attendance prizes had been awarded to women guests, the remainder of the evening was devoted to cards.

Physicist Demonstrates Atomic Radiation

Dayton, Ohio—Paper of an established thickness stops alpha rays, aluminum is a barrier for beta rays, but gamma rays can pass through one and one-half inches of lead. The relative powers of penetration of these nuclear fission products were demonstrated for Dayton members with a Geiger counter by Dr. Edward Orban of Mound Laboratory, Monsanto Chemical Co., Miamisburg, Ohio.

As guest speaker at a dinner meeting, January 8, at Suttmiller's Restaurant, Dr. Orban lectured on "Atomic Energy and Its Uses." He dealt chiefly with industrial applications and a few uses in the medical profession.

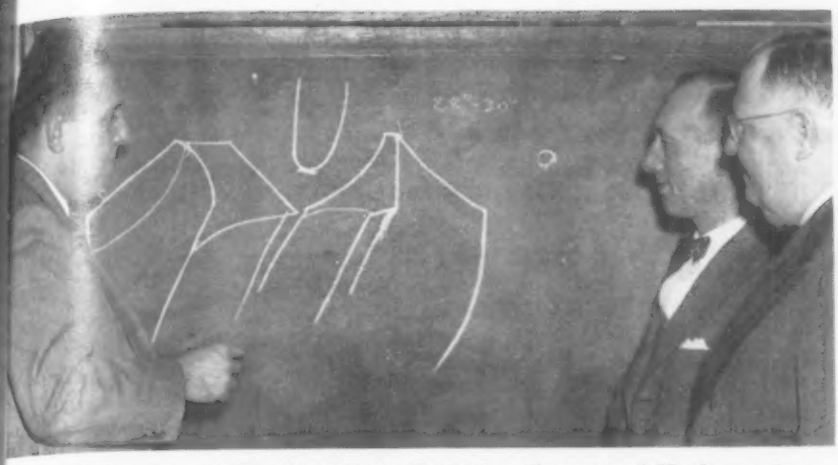
Part of the discussion touched on the effect and probable damage of an atomic bomb exploding above Third and Main streets in Dayton. At another point in his address Dr. Orban speculated on future development of atomic power for consumption in isolated areas, and for propelling submarines, battleships and aircraft.

Industrial uses of the by-product radioisotopes include such examples as "hot" piston rings for lubrication studies.

The speaker showed slides and exhibited several pieces of apparatus used in atomic study. He was introduced by L. R. McAfee, acting first vice-chairman.

Prior to the talk a short business meeting was called by Chairman C. R. Miller for the purpose of electing an annual Nominating Committee. H. O. Poock was chosen chairman, with George C. Tillotson and Gordon J. Letsche as members of his committee.

Vernon Ashby of Ideal Pure Milk Co. emcees ladies night program at Evansville chapter. Others, from left, are Mrs. Walter Stippler, Chairman Stippler, J. L. Cooperider (speaker) of Central High School, and Mrs. Charles Thuman, wife of the first vice-chairman.



E. A. Brezina of Cleveland Twist Drill Co. illustrates drill sharpening for Philadelphia chapter as G. H. Stimson of Greenfield Tap & Die Corp. and L. S. Paulsen, chapter chairman, look on.

Draw Parallel Between Action of Tap, Reamer

Philadelphia, Pa. — Approximately 150 members and guests of Philadelphia chapter turned out for the drilling, tapping and reaming symposium featured on the January program. G. H. Stimson of Greenfield Tap & Die Corp. and E. A. Brezina of Cleveland Twist Drill Co. were speakers at the dinner meeting held on the 18th at the Engineers Club.

Both speakers agreed on a surprising similarity in the cutting action of taps and reamers. Entering cutting edges have the same job to do. The tap has an inbuilt feed-per-revolution, while the reamer can be fed at a variable rate as controlled by the machine setting. Both types of tools are sharpened only on the leading cutting teeth.

Give Attention to Details

Shop troubles in both cases, they pointed out, are usually solved by attention to proper sharpening, good alignment of tool and work, and correct operating speed.

Mr. Brezina's motion picture presentation emphatically showed right and wrong ways of selecting, storing, sharpening and using all types of reamers.

In discussing tapping problems, Mr. Stimson touched on the recently developed unified system of screw thread standards. When this system is universally adopted, he said, the reduction in thread classes and pitch diameter combinations will result in fewer tap sizes.

During a business session, a Nominating Committee was elected, composed of Edward Holden, Walter V. Czarnecki, Jr. and Walter Phifer.

Howard W. Gross, a former chairman, gave the invocation before dinner.

Ray Bextine, Ernest Smith and Woodrow Thompson, visiting engineers from the Cedar Rapids plant of Link-Belt Co., were among guests introduced.

Knight Elected Chairman By Kansas U. Students

Lawrence, Kans.—The University of Kansas student section of Kansas City chapter elected and installed new officers at a smoker held January 10.

Harold Buddenbohm, retiring chairman, conducted the election and installed Charles L. Knight as his successor. Chairman Knight introduced the members of his staff as follows: Jack E. Kidney, vice-chairman; John P. Gerdel, secretary-treasurer, and Floyd I. Palmer, parliamentarian.

Mr. Buddenbohm expressed appreciation for the cooperation of officers serving during his administration.

Howard O. Rust, faculty advisor for the student group, welcomed the new officers. Prospective job opportunities with Kansas City firms were discussed by John Hoover of the Marley Co., Inc., Kansas City, Kans., a former chairman.

Following the showing of two films, refreshments were served.

Describes Engineering For Push Button Home

Chicago, Ill.—The Dream Home of the Future, with electric push button control, was described by Herman Goldberg, president of Snow Manufacturing Co., to approximately 125 Chicago members and their guests. Mr. Goldberg was the speaker at the January 9 chapter dinner meeting at Midwest Athletic Club.

Mr. Goldberg also talked on cutting engineering costs and the danger of over-engineering a job.

Marshall Blu, chairman for the 1952 ASTE exposition, gave a progress report on his committee's activities and asked for volunteers.

Thomas C. Barber, chapter chairman, opened the meeting with remarks concerning election of officers and the March annual meeting at New York.

Piedmont Officer Injured In Southern Plane Crash

Charlotte, N.C.—Edwin J. Zagora of J. Zagora Machine and Gear Co., Charlotte, narrowly escaped death on January 16 in a four-passenger Stinson plane which crashed and burned shortly after taking off from Cannon Airport.

Airport employees who witnessed the crash said that the passengers were fortunate to escape with their lives, since flames completely destroyed the plane.

Mr. Zagora, who was starting on a business trip to Baltimore, Md. with two associates, was believed to be the most seriously injured of the three. A passing motorist took him to Memorial Hospital in Charlotte for treatment. He is recovering from several fractures in both arms, burns and lacerations.

Mr. Zagora is chairman of the Education Committee of Piedmont chapter at Winston-Salem.

Cites Tooling Importance To Incentive Systems

Cedar Rapids, Iowa—Merits and disadvantages of wage incentives were presented to local industrial executives attending Bosses Night at Cedar Rapids chapter. E. A. Cyrol, Chicago management consultant, discussed this subject at the chapter's January 17 dinner meeting at Montrose Hotel.

E. A. Cyrol

Factors emphasized included proper tooling, and a good methods improvement program both before and after setting up an incentive system.

During the coffee period Tait Cummings, sports director for Radio Station WMT, entertained as raconteur.

Raymond Bextine, Robert Hruska, and John Stark, all former chapter chairmen, were elected to serve as Nominating Committee.

Rigdon, Wallis Advanced

Pittsburgh, Pa.—Two ASTE men have been promoted by Westinghouse Electric Corp. in appointments announced by L. E. Osborne, vice-president.

L. D. Rigdon, formerly manager of the Headquarters Manufacturing Division, has been named assistant to vice-president in charge of manufacturing.

C. G. Wallis succeeds Mr. Rigdon as manager of the Headquarters Manufacturing Division. Mr. Wallis has held a number of executive posts since joining Westinghouse in 1923.

Both men are affiliated with the Pittsburgh ASTE chapter.

Coming MEETINGS

(Bridgeport, Conn.) Fairfield County—April 4, Pitney-Bowes, Inc., Stamford. Speaker: J. W. Dopp, supervising engineer, Lapointe Machine Tool Co. Subject: "Application of Broaching Machines to Jet Engine Production." May 2, Stratfield Hotel, Bridgeport. Speaker: W. W. Goehring, machine tool engineer, S.K.F. Industries. Subject: "Anti-Friction Bearings and Their Uses in Machine Tools."

Chicago—March 17-21, 1952, Tool Engineers Industrial Exposition.

Detroit—April 12. Plant Tour. Student Section: April 19. Plant Tour.

(Flint) Saginaw Valley—April 19. Plant Tour, Fisher Body No. 1 Press and Assembly.

Hartford—April 2. Dinner 6:15 p.m., Hartford City Club. Technical session 8:15 p.m., Hartford Gas Co. Auditorium. Speaker: R. E. McKeith, U.S. Tool Co. Subject: "Production of Precision Formed Metal Stampings."

(Newark) Northern New Jersey—April 10. Speaker: L. D. Miles, Value Analysis Div., purchasing dept., General Electric Co., Schenectady, N.Y. Subject: "Value Analysis." May 8. Speaker: H. J. Greif, regional manager, Eutectic Welding Alloys Corp. Subject: "New Welding Methods and Rods for Salvaging Tools and Dies."

New Haven—April 12. Plant Tour, Sargent & Co.

Philadelphia—April 19, Engineers Club. Speaker: Albert Lee, Almco Co. Subject: "Deburring." May 17. Speakers: W. Van Ormer and Boyd H. Work, Carborundum Co. Subject: Grinding Symposium.

(Springfield, Vt.) Twin States—April 11, Windsor House, Windsor. Speaker: G. H. Stimson, Greenfield Tap & Die Corp. Subject: "Unified Screw Threads." May 9, Springfield. Speaker: O. E. Olivieri, J. K. Smit & Sons, Inc. Subject: "New Applications of Industrial Diamonds and Powdered Metals."

Toronto—April 4, 7:30 p.m., Oak Room, Union Station. Speaker: Prof. E. A. Allcut, University of Toronto. Subject: "Gas Turbines in Industry." April 6, Royal York Hotel. Ladies Night.

(Washington, D. C.) Potomac—April 5, Dodge Hotel. Speaker: R. E. Coleman, distributor for Pivot Punch and Die Corp., North Tonawanda, N. Y. Subject: "Pivot Punches, Their Use and Application." May 10. Speaker: Dr. H. B. Osborn, Jr., technical director, Tocco Div., Ohio Crankshaft Co., Cleveland, Ohio. Subject: "Induction Heating."

Worcester—April 3, Putnam & Thurston's. Speaker: A. N. Kugler, technical engineer, Air Reduction Sales Co. Subject: "Inert-Gas Arc Welding." May 8. Plant Tour, A. G. Spaulding Co., Chicopee, Mass.

(York) Central Pennsylvania—April 2. Speaker: C. A. Reimschissel, chief development engineer, Landis Machine Co. Subject: "Use and Application of Thread Generating Processes."

Position Available

MAN with cutting tool background, with aggressiveness and aptitude for selling. State background, expected earnings, etc. Address answer to Box 229.

Situations Wanted

ASSISTANT WORKS MANAGER—Available preferably for tooling, cost reduction analysis and personnel department supervision. Has record of more than 100 percent gain in tooling production and tool and die experiments resulting in large increases in output. Experienced in textile machinery, aircraft engine, boat, glass and electric industries. Box 231.

CARBIDE TOOL ENGINEER—Qualified for tool supervisor or carbide coordinator. Background of tool fabrication, design, estimating, production and application of tools, dies and wear parts. Has 15 years' experience as toolmaker, own business, carbide supervisor. Present position in high production automotive applications. Age 36; salary required $6,500. For resume write: Box 226.

ENGINEERING EXECUTIVE—37, married, Cal-Tech graduate, 15 years' experience, 8 years metalworking and tool industry as chief engineer and manager in charge production, engineering, and sales. Extensive carbide tool and manufacturing experience. Servomechanism and automatic machine tool contour system development. Wishes responsible management or engineering position. Box 230.

Address replies care of American Society of Tool Engineers, 10700 Puritan Ave., Detroit 21, Mich.

Weinreich Manages Plant

Buffalo, N.Y.—William F. Weinreich, formerly assistant superintendent of machine shops at the Buffalo plant of Worthington Pump and Machinery Corp., now has charge of the firm's newly acquired Oil City, Pa. plant. He has been named assistant to Vice-President Austin C. Ross, administrative head of the latter plant.

A member of Buffalo-Niagara Frontier chapter, Mr. Weinreich was educated in Germany and joined Worthington in 1930 as tool room foreman.

Obituaries

Eugene E. Edmiston

Piedmont chapter lost its first and oldest member when Eugene E. Edmiston, 75, plant engineer, Mooresville Mills, Mooresville, N.C., passed away January 19 at Lawrence Hospital in that city. Mr. Edmiston succumbed to a three-days' illness of uremic poisoning.

Known as the dean of southern master mechanics, he was loved by all who knew him. When he was 74 Mr. Edmiston applied for membership in the Society, with a record of 55 years as mechanic and master mechanic at Mooresville Mills. In his final capacity as plant engineer he had charge of the machine shop, power and electric plants, and carpenter shops.

A member of the company's board of directors, he was a former general chairman of the Southern Textile Association. He was also a director of the Mooresville Federal Savings and Loan Association, the Lawrence Hospital and the Rotary Club. In addition, he had served on the town's Board of Commissioners.

A story of Mr. Edmiston's lifetime career with the Mooresville Mills appeared in the September 1950 *ASTE News*.

Fred L. McCarthy

Fred L. McCarthy, 59, for more than 30 years Detroit district manager for the Jacobs Manufacturing Co., Hartford, Conn., passed away January 16 at his home in Grosse Pointe Park, Mich.

Mr. McCarthy was a native of Elgin, Ill. and was educated in the Chicago schools. He received his technical training at Lewis Institute of Technology.

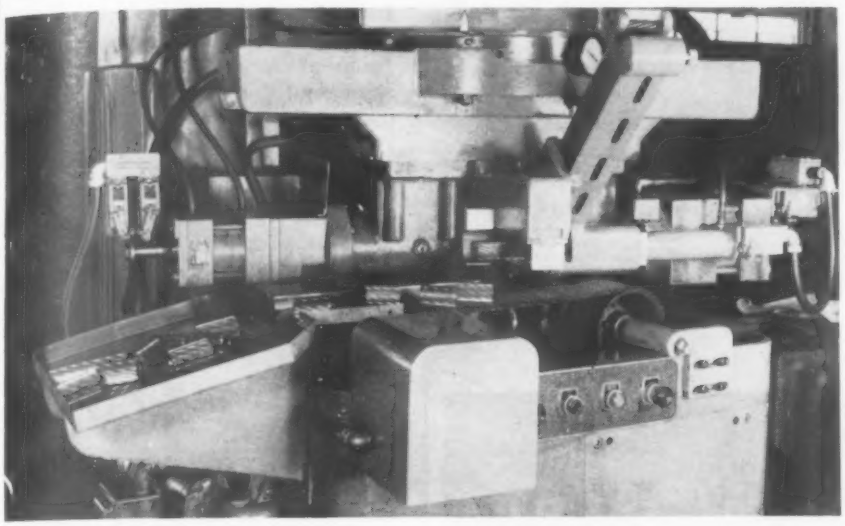
At the time of his death he was a member of the Detroit ASTE chapter, the Detroit Athletic Club and the Lochmoor Country Club.

A.S.T.E. News

Continued on page 79

Tools of Today . . . .

Automatic Attachment Speeds Unloading



A low-cost, universal Automatic Unloading Attachment for rotary gear shaving machine, announced by Michigan Tool Company, 7171 East McNichols Road, Detroit 12, Mich., is designed for conversion of shaving machines to automatic unloading. Said to be especially adaptable to unloading of small gears on machines already equipped for automatic loading, it reduces operator fatigue and cuts costs by enabling one operator to service several machines.

As shown by the illustration, in which the guards are removed for clarity of detail, this self-contained unloader incorporates a small wire mesh belt which travels over two drums. Drive is by a fractional hp motor and provision is made for taking up belt slack. Note the automatic loader shown at upper right.

Among advantages claimed for use of the wire mesh belt may be included the following: Since the belt moves at a relatively low, constant speed, it permits cutting fluid to drain back into the machine before the gear is discharged into the collecting pan. The belt, of material softer than the gears being shaved, has a certain amount of give which prevents damage to the finished gear as would ordinarily result from striking another gear or a conventional metal chute. Also, the wire mesh provides longer belt life and freedom from damage by cutting fluid.

The unloader is designed for quick attachment to any Michigan Tool Company No. 870 or 870A automatic gear finishing machine, in any of several positions and without any other changes in the machine except the drilling and tapping of a few holes for mounting brackets and the discharge chute.

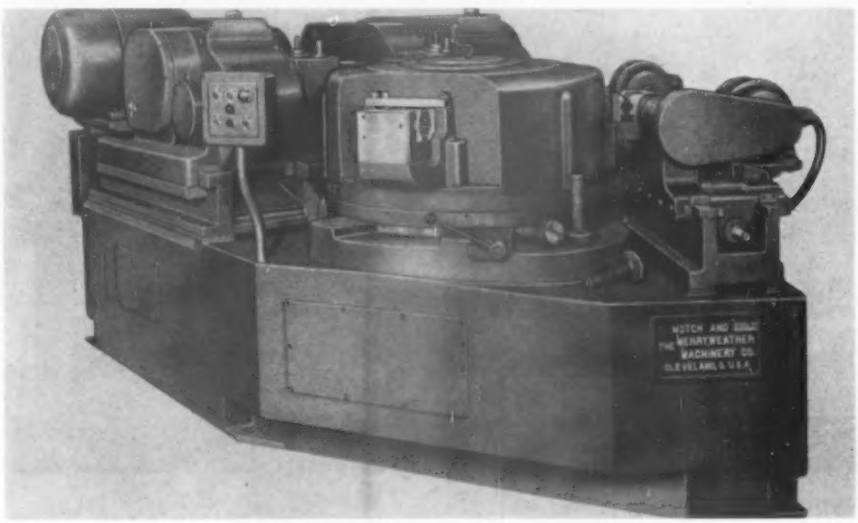
T-4-651

Production Milling and Center Drilling Machines

The Motch & Merryweather Co., 715 Penton Bldg., Cleveland 13, Ohio, has introduced a milling and center drilling machine designed for high production. For example, forgings or shafts ranging from 4 to 16 in. long can be simultaneously milled and center drilled, at a stated output of 220 to 240 pieces per hour, while the operator is loading and unloading.

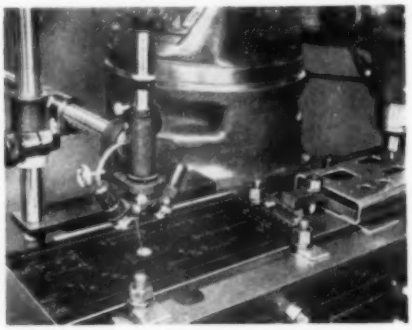
The machine, which incorporates a 48 in. table mounting three work-holding fixtures, opposed milling and opposed drill heads, is semi-automatic. Depressing a lever clamps the loaded workpiece; then, on pressing the cycle button, the index table rotates 120 deg, the opposed milling heads advance in rapid traverse, feed and rapid return. The table then indexes 120 deg to the center drilling stations for double-end operation. At the next index the fixtures automatically open to permit unloading and reloading.

The machine features the Motch & Merryweather M-30 single-speed milling heads, said to be capable of face milling alloy steel pinions at a 24 to 30 in. per minute feed rate. These heads can utilize up to 30 hp and have 2 in. of quick adjustment for cutter setting. The index table, which is hydraulically actuated and cushioned, is relieved during rotation and solidly locked for each machining station. Lubrication at all parts is automatic. **T-4-652**



Optical Follower

An optical follower duplicating instrument, for precision hole spacing work and specifically designed for attachment to the Bridgeport and other knee type milling machines, is announced by the Boeckeler Instrument Co., Tucson, Ariz.



In operation, it visually follows a template plate for duplication on the workpiece, giving coordinate locations said to be accurate to 0.0002 in. The tracing finger employed on conventional duplicating machines is replaced with a fully adjustable 32 x microscope.

The template plates for use with the follower are made with a height gage or other conventional layout method, the pattern being scribed on steel, aluminized glass or other suitable material. Thus, setup time for any hole duplication job is greatly reduced while, at the same time, there is commensurate increase in accuracy. Possibilities of human errors are practically eliminated since, when drilling a specific hole, the operator using the follower must have the scope crosshairs on the cross lines of the layout; therefore, there is remote chance of being off an entire turn of the lead screw and thus ruining the workpiece.

T-4-661

Continuous Wire Gage

Federal Products Corp., Providence 1, R.I., announces a continuous wire measuring gage—Model 493 B-80—that automatically controls the amount of material an extruder deposits on the wire.

Designed to handle wire of any size up to 1 in. diameter, the gage automatically speeds up or slows down the speed of the wire as it passes through the extruder. This not only controls the proper deposit of insulation material, to conform to Underwriters' requirements, but saves material by preventing excessive deposit. **T-4-662**

Shrink Rules

The L. S. Starrett Co., Athol, Mass., has added Nos. 366 and 367 to their line of pattern makers shrink rules. Providing $^{11}/_{32}$ and $^{13}/_{32}$ shrink per foot, respectively, the rules are available in 12 and 24 in. lengths. Graduations are machine divided in $^{1}/_{8}$, $^{1}/_{16}$, $^{1}/_{32}$ and $^{1}/_{64}$ shrinkage inch.

Also by Starrett, is a set of attachments that converts a combination square into a height or depth gage at low cost. This No. 289-C consists of a clamp lock, scriber, a 6 in. rule and a 6 in. rod, the two latter for use with Starrett's previously announced No. 289 attachment. Except that it does not incorporate a vernier, the conversion functions as a practical height-depth gage for a wide range of layout work.

T-4-663

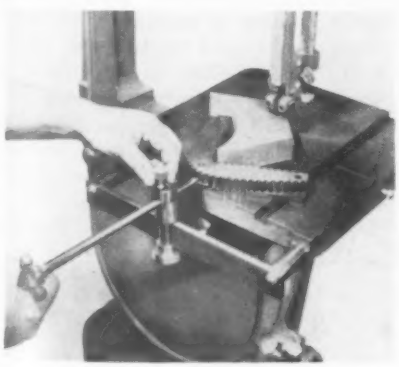
Measuring Machine

A measuring machine, designed for precision measurement with direct optical reading to 0.00005 in. without use of micrometer screws, is now available from Hauser Machine Tool Corp., 30 Park Ave., Manhasset, N.Y. A product of Henri Hauser Ltd., Bienne, Switzerland, this machine—designated the Hauser Type P324—features universal application, simple handling, and direct optical reading of measurements in graduations of 1.000, 0.100, 0.010, 0.001, 0.0001, and 0.00005 in.

Technical details follow in brief: measuring range, 4 x 4 in.; measuring table, 9½ x 6 in.; reading microscope 100 x magnification; measuring scope, 45 x magnification; centering scope, 35 x magnification. A center punch fits concentrically with the scope carrier, for measuring and centering. **T-4-671**

Screw Feed Attachment

The Power Tool Div., Rockwell Mfg. Co., Milwaukee 1, Wis., announces a screw feed attachment as an added convenience for use with the Delta 14 in. metal cutting band saw. The device features a fingertip feed screw release for quick adjustment, a star wheel to provide effortless feed action, an adjustable jaw usable in any position for handling irregular shaped work, and a laterally adjustable pivot block. As designed, the entire screw assembly may be quickly removed to provide complete table clearance. Complete information may be had from the manufacturer. **T-4-672**



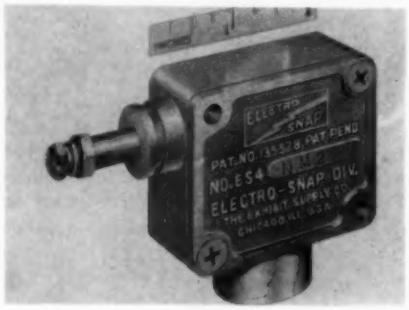
Variable Speed Drive

The No. 150 Series of Graham drives is designed for lower input speeds than those previously used, which ranged in sizes from ½ to 1-1-½ hp and were standardly driven at 3600 rpm and, where lower speeds were used, were spring loaded. The 150 series is designed for input speeds of 1800 and 1200 rpm and are without spring loading.

The lower input speed is said to give cooler and quieter operation with increased efficiency and greater durability under the most severe continuous duty applications; also, absence of spring loading makes it possible to change the speed of the transmission both while running and while stationary. Inherent overload protection prevents damage due to overload or jam in the driven equipment. **T-4-673**

Limit Switch

Announced by the Electro-Snap Div. of the Exhibit Supply Co., 4218-30 W. Lake St., Chicago, Ill., is the ES4-NM series of limit switches especially designed for use with momentarily-pulsed solenoid-operated valves for air or hydraulic circuits.



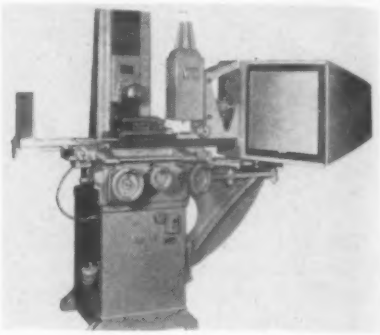
With these switches, and depending on the speed of the actuating member, "on" time can be selected to give $\frac{1}{10}$ to $\frac{2}{10}$ second impulse to the momentarily pulsed valve. For example, a slowly actuated switch need only be on for $\frac{1}{16}$ in. of plunger travel, while a faster switch actuation may require as much as $\frac{5}{16}$ in. "on" period to provide a $\frac{1}{10}$ second impulse.

The switches are furnished in $\frac{1}{16}$, $\frac{1}{8}$ and $\frac{3}{16}$ in. standard lengths and may be had with "on" time lengths up to $\frac{3}{8}$ in. on special order. A simple flat dog, attached to the cylinder piston rod, obviates use of one-way dogs.

T-4-681

Contour Grinder

Construction improvements in the Visual-Grind contour grinder, by the Cleveland Grinding Machine Co., 6514 St. Clair Ave., Cleveland 3, Ohio, include increased rigidity with consequent greater precision. Supports for the optical projection section is now a heavy aluminum-alloy casting, and other improvements include fins, in the lamp housing, for increased radiation and dispersal of heat to prolong lamp life.



The lamp housing, riding on dovetail ways, is adjusted by hand wheel, worm gear and screw, while a pre-set lens tube assures positive focus. Variable powered longitudinal feed of the table relieves the operator of hand feeding during the rough and finish grinding phases. **T-4-682**

Small-Hole Drills

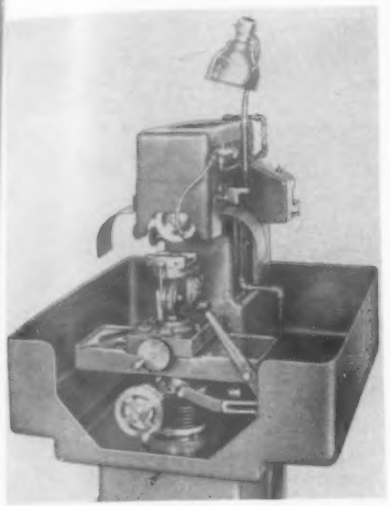
An interesting development in small-hole drilling, announced by Louis Levin & Son, Inc., 782 E. Pico Blvd., Los Angeles 21, Calif., incorporates collets for chucking of fine drills. For while conventional drill chucks may cause a runout of several thousandths on the ordinarily used drills, without resulting in breakage, a drill 0.010 in. in diameter would break if the runout were only about 0.002 in.

To insure true running of small drills in their micro-drilling machines, the Levin spindle is provided with collet chucks calibrated to the size of the drill. These collets are available in sizes from 1 mm—0.004 in.—up to 5 mm or 0.197 in. in increments of 0.05 mm. Special collets up to $\frac{1}{4}$ in. are available; however, the maximum recommended size for the Levin drill is $\frac{1}{8}$ in. **T-4-683**

USE READER SERVICE CARD ON PAGE 77 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Carbide Tool Grinder

Hammond Machine Builders, Inc., 1661 Douglas Ave., Kalamazoo, Mich., has added Model CB-77-W to its line of carbide tool grinders. This is a combination chip breaker and diamond finishing grinder, designed for wet grinding to produce an extra-fine finishing to cutting edges.



The cup wheel side is for diamond finishing, while the chip breaker side is not only for grinding chip breakers but is also designed for use with the recently announced Hammond VC solid carbide insert grinding fixture. Coolant is provided by a self-contained pump and tank unit, and coolant spouts can be swiveled to direct flow to any desired point. **T-4-691**

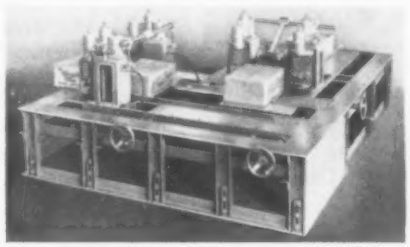
Drill Jigs

Resuming post war manufacture of drill jigs, the Universal Tool Co. of California now makes available the Parlec box drill jig in five standard sizes: 1½ x 2 in., 3 x 3½ in., 3½ x 5¾ in., 6 x 6 in. and 1½ x 6 in. Special sizes may be had on order.

Master layouts, to be placed under parts drawings, provide a short cut to tool layout and are available at no extra cost. Universal also markets a drill jig for round stock, all described in company literature available from Franklin E. Smith & Associates, 6201 Carmelita Ave., Bell, Calif. **T-4-692**

Shipping Case Printer

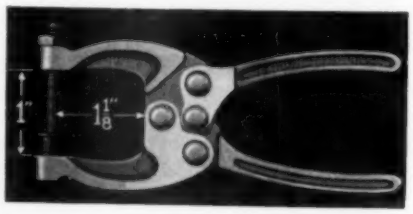
Of interest to manufacturers who package their products for shipping is a machine that automatically prints complete display designs on all four sides of corrugated fibre and wooden shipping cases. Introduced by Adolph Gottscho, Inc., Hillsdale 5, N.J., this Markocoder Model No. 3M-18-4E makes it practical for companies with varied product lines to print their own cases, as they are used, instead of maintaining large inventories of preprinted containers for each different product and size.



Placed on a production line following a packaging station, the machine automatically receives loaded cases, separates them for registration, prints the side panel—and top if required—and discharges them, all in a single pass. **T-4-693**

Plier-Type Clamp

A light portable plier-type toggle clamp—"Destaco" No. 424—is announced by Detroit Stamping Co., 328 Midland Ave., Detroit 3, Mich. Expressly designed for aircraft assembly, sheet metal and body work, and for holding metallic and non-metallic parts during machining, it provides positive holding pressure with a firm toggle locking action.

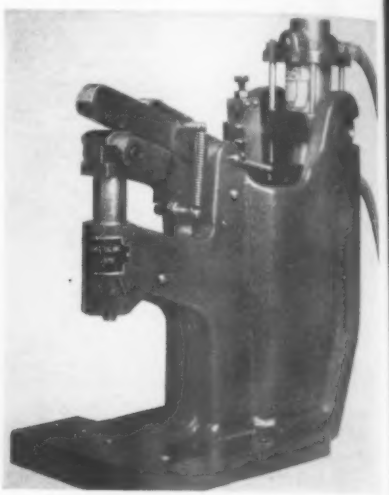


Weighing only 5 oz. and having an overall length of 4½ in., its lightness and compactness allows one-hand use in restricted working areas. Handles and jaws are forged high-alloy steel; bearing pins long-wearing stainless steel. Descriptive bulletin available.

T-4-701

Staking Machine

An air-operated staking machine, recently introduced by The High Speed Hammer Co., Inc., Rochester, N.Y., is expressly designed for staking or riveting fixed or movable joints. Its adaptability covers such operations as eyeletting, inserting grommets, burring, and pointing with platinum, tungsten or silver. The standard machine is furnished with an air foot switch, but dual hand controls can be furnished at extra cost if desired.



A feature of these units is the double-action, the spindle being constructed with a pressure pad which compresses or assembles the work prior to staking. The weight of the hammer blow is readily adjustable for the required blow for each job, and a trip-dog action insures a uniform blow despite slight variations in stock thickness.

The company offers the services of their engineering and experimental departments so that, by submitting sample assemblies of riveting problems, they will make a study of a particular problem, and return the assembly properly riveted with complete analysis, recommendations and quotations at no charge. T-4-702

Universal Joint

The Curtis Universal Joint Co., Inc., Springfield, Mass., announces their "Lo Friction" universal joint, now available in single or double joint form, solid or bored hubs for round, keyed or splined shafts, and in sizes 1¼ in. O.D. or larger.

Developed primarily for industrial applications where the joint friction heat or kinetic energy must be dissipated rapidly, its effectiveness is found in the friction block of the joint. Reduced bearing surfaces and provision for adequate and constant lubrication has resulted in what is claimed to be a truly heat resistant joint. T-4-703

Precision Spindles

Vulcanaire spindles, employing the same type of infinitely controlled high-speed, air operated and cooled motors used on the Vulcanaire jig grinder, are now available from Vulcan Tool Co., 730 Lorain Ave., Dayton 10, Ohio, as super-precision units for a wide range of spindle applications.

Only 3⅝6 in. long, they may be adapted to machine tools for high-precision production finishing of contours on hardened steel working surfaces; on pantograph engraving machines, using carbide and H.S. steel points; on internal grinders for efficient grinding of small holes; and for such work as finishing of instrument and optical parts among a wide range of uses.

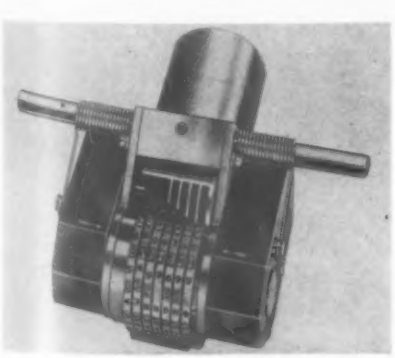
T-4-711

Automatic Stamps

The Parker Stamp Works, Inc., Hartford, Conn., announces a line of automatic numbering heads for punch press stamping. Standard numbering heads permit numbering from 1 to 9999999999 in sharp face Gothic characters for any material including steel; or in flat face Gothic or shaded Roman, recommended for use on brass or other soft metals.

The maker guarantees sharp, accurate stamping of consecutive or repeat numbers. A duplicating attachment can be added if required. Direct reading is possible on the larger heads, which enables determination of machine settings at a glance from engraved numbers on front of the lettering wheels.

T-4-712

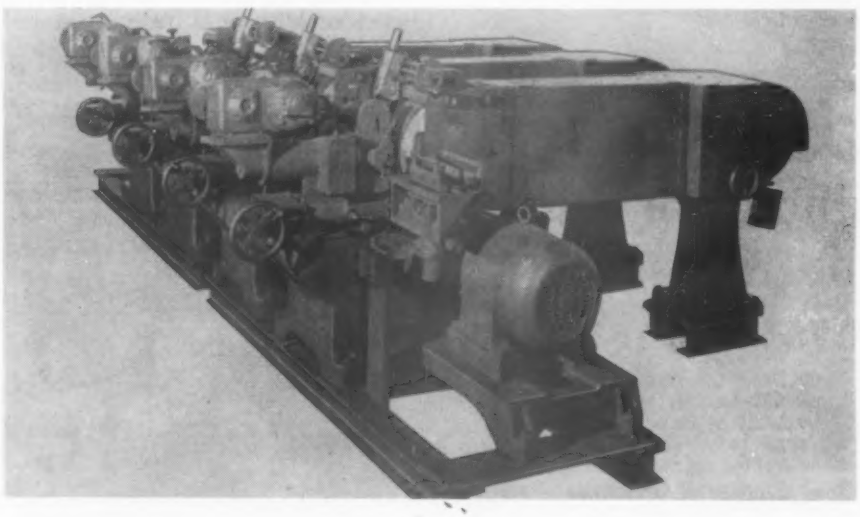


High Speed Centerless Polishing Machine

Announced by Production-Machine Co., Greenfield, Mass., is a centerless polishing machine which, while maintaining the same general design as the company's standard machine, has a completely redesigned work feeding unit and motorized variable speed feed drive assembly. Design changes also include a large wheel spindle with capacity for contact wheel or buffs up to 6 in. wide.

As indicative of performance, two machines in tandem polished welded steel tubing at a rate stated as 70 ft. per minute. Because most tube polishing requires several passes, these machines are usually installed in groups of from two to six units. Shown is a typical installation of four machines, the first three equipped with idler backstands and the fourth arranged to buff as a final operation.

T-4-713

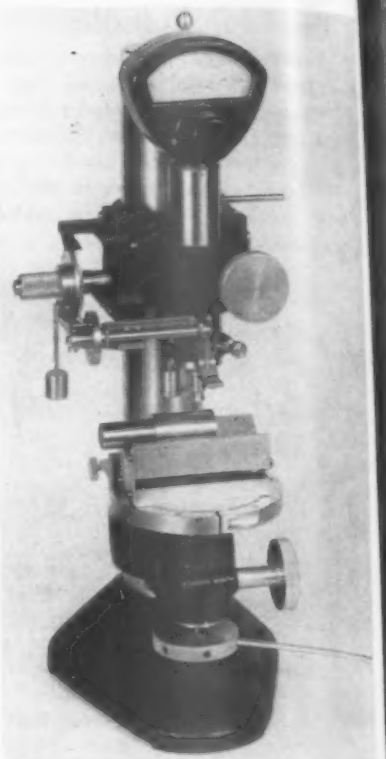


Ultra-Precision Gages

The Mikrokator principle of precision gaging, as developed by the C. E. Johansson Company of Eskilstuna, Sweden, has latterly been expanded to include several recent precision measuring instruments. The basic principle, which incorporates a twisted metal strip to provide a frictionless, mechanical amplification, is said to establish measuring differences to a millionth of a millimeter—0.0000004 in. very nearly—without resort to optical or electrical accessories.

Among these instruments is the No. 530 surface finish indicator—upper photo—which operates within a variation of measuring pressure of less than 0.2 grams. Minimum measuring pressure is 0.3 grams. Using a needle with a minimum tip radius of 0.00008 in. and an angle of 20 deg., it will measure finely ground and even lapped surfaces.

Among other adaptions of the Mikrokator is the Ridermikrokator No. 521, designed for measuring of diameters from 10 to 32 in.; also, for measuring camber on rollers. In principle, this instrument incorporates two gage points which establish the chord of a diameter.

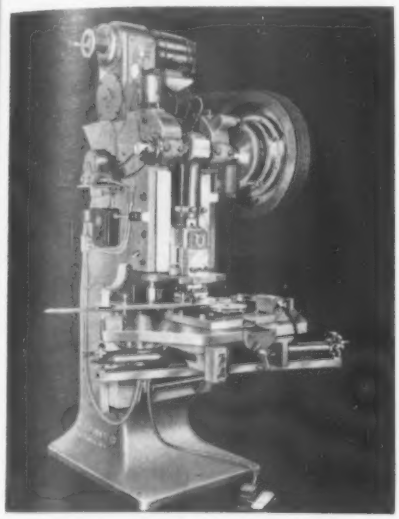


The indicator finger, located centrally between these points, can then be set for the desired diameter by means of a simple calculation. Thus, the instrument serves as a micrometer for any diameter within the stated 10 to 32 in. range. This instrument is somewhat similar, in superficial appearance, to the Mikrokator gage shown below, which is an adjustable snap-type gage designed for measurements within millionth tolerances.

As a departure from dimensional measuring, Johansson has also applied the Mikrokator to a novel hardness testing machine of such sensitiveness that, as claimed by the maker, it can be applied to testing of painted surfaces and foil, without penetration. Literature and complete information on these and other precision gages is available on request from the C. E. Johansson Gage Co., Division of the Swedish Gage Company, 8900 Alpine Road, Detroit 4, Mich. T-4-721

Notching Press

The V & O Press Co., Div. of Hartford-Empire Co., Hudson, N. Y., has developed a segmental notching press used for the notching of rotor or stator segments of the larger sizes which cannot be readily handled on the conventional index ring type of fixture. Capacity is listed from 24 in. diameter segments up to a straight line.



A simple, air-operated arrangement is provided. The operator places the segment blank in position on the fixture and steps on a foot switch. The segment automatically moves into notching position against a stop, which immediately starts the press and performs the prescribed notching operation. At the end of the cycle, a micro switch action stops the press and returns the notched segment to its original position for removal.

The unit is simple, inexpensive to tool and maintain for the various number of notches required. No index ring is required as the spacing is provided in the die. **T-4-731**

Drill Jig Templates

With a view toward expediting drafting in machine and tool design, Siewek Tool Co., 2860 E. Grand Blvd., Detroit 2, Mich., now makes available full-size, individual template tracing sheets covering their rack-and-pinion and spring-type drill jigs. Siewek products not included in these sheets are covered in tabulated form in Catalog No. 7. All requests for the template sheets and catalog must be on company stationery. **T-4-732**

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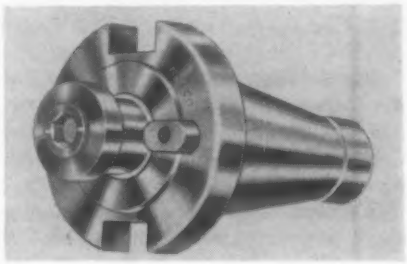
Milling Arbors

The Nelco Tool Company, Manchester, Conn., announces their shell milling cutter type C arbor which, as all sizes are equipped with socket head standard lock screws, requires no special wrench. It is universally adaptable to milling machines and cutter grinders having National Standard spindle tapers. Available in ½ to 2 in. diameters, this arbor is manufactured from chrome-molybdenum steel, precision ground and heat treated for long accurate life. Removable keys make it possible to install side milling cutter if necessary. Information on this and other Nelco Tools is available on request. **T-4-733**



South Bend Improves Gear Box Design

A redesigned and simplified quick change gear mechanism, designed to save time and to give long, dependable service is now being furnished on 14-½ and 16 in. swing South Bend lathes. Having a minimum number of parts and being fitted with ball and needle bearings, the mechanism requires less power and is also considerably sturdier than previous designs.

A direct reading index chart shows positions in which the two conveniently located tumbler levers are placed for each of 48 screw thread pitches, 48 power longitudinal feeds, and 48 power cross feeds. There are no sliding clutches or sliding primary end gears to change; rather, shifting a single lever changes feed instantly from coarse to fine for roughing or finishing cuts.

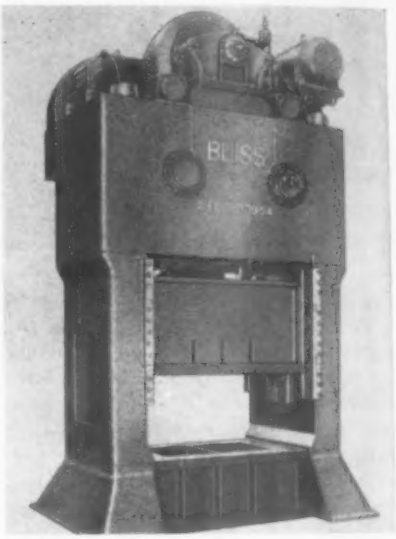
Standard screw threads from 8 to 224 per inch are obtainable by shifting the two tumbler levers on the gear box. The stud gear is changed for an additional series of coarse pitches ranging from 4 to 7 threads per inch. Provision is also made for the use of a special stud and intermediate gearing needed to cut metric screw threads, the regular gear guards being so constructed that they enclose either gearing.

Complete information and specifications on lathes equipped with this revised gear-change box may be had from the South Bend Lathe Works, South Bend 22, Indiana. T-4-741

Eccentric Presses

Development of a line of two-point eccentric presses for general-purpose blanking, forming and drawing is announced by E. W. Bliss Co., Canton, Ohio.

To withstand the most severe round-the-clock operating conditions, the two main gear eccentric units are designed with unusually heavy sections and are further mounted on and keyed to extremely large diameter shafts.



Torsional and axial deflections are said to be practically eliminated by having the shafts revolve in crown bushings, while maximum rigidity is achieved through use of short uprights and deep crown sections. Lubrication, consisting of a combination of cascade and pressure types, is automatic. The drive is double-geared, with two separate intermediate shafts running in oil bath. Dimensions and specifications for the new presses are in accord with the standards established by the Joint Industry Committee.

The fast-acting Bliss single-disc pneumatic friction clutch is furnished as standard equipment. This clutch is cool-running and requires no adjustment since the clutch and brake plates are self-centering and wear on the friction surfaces is compensated automatically. Replacement of worn-out friction plates is readily accomplished without disassembling the clutch, or any part of the press. The brake is integral with the clutch, and arranged to prevent engagement of both at the same time. T-4-742

Bushed Wheels

Precision bushings for grinding wheels are the latest development in grinding wheel manufacture announced by Norton Company of Worcester, Mass. Pressed into the wheel, these bushings are said to have several distinct advantages over poured lead bushings which have been standard practice for many years.

These precision bushings are designed to maintain more consistent hole size from wheel to wheel, with consequent advantages of uniform mounting conditions for the user, while the press fit method of mounting the bushing insures greater holding power of the bushing within the wheel. At the present time these Norton precision bushings are being used in straight wheels 5 to 8 in. in diameter. **T-4-751**

Mirror-Oscilloscope

The Simpson Electric Co., 5200 W. Kinzie, Chicago, Ill., announces the Model 476 Mirroscope, designed to save space on the testing bench. By use of the Mirroscope principle, the 5 in. cathode ray tube is mounted in a vertical position to reduce bench requirements to an area of 9 x 8 in. Height is 16¼ in.

The cathode ray image is reflected from a mirror mounted in the adjustable cover at the top of the cabinet; thus, the viewing surface is brought near the eye level when the instrument is used on benches. **T-4-752**

Magnetic Conveyor

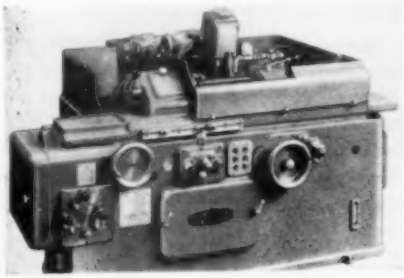
A Permanent Conveyor Element, developed by the Eriez Manufacturing Co., Erie, Pa., is available in three styles for conveying skelp, plate, sheet, rod, bar, pipe and shapes.

Advantages claimed for the permanent magnetic conveyor include the simplicity of maintenance and repair since standard iron pipe length or sections can be used as the revolving induced magnetic unit. In addition, a maximum amount of conveyed magnetic material is said to be subjected to the direct action of the magnetic field, as the major field is at right angles to the material movement. Another feature stressed by the manufacturer is that the magnetic strength of the unit can be adjusted by changing the air gap between the plate magnet and revolving members suspended above.

Typical applications for the conveyor, described by the maker, include feeding or handling of materials to operators or working equipment in pipe roll mills, sheet and plate mills and stamping plants, or the conveying of iron and steel stock in warehouses. **T-4-753**

Thread Grinder

Cosa Corporation, 405 Lexington Ave., New York 17, N.Y., introduces to American industry the Type NRK universal thread and worm grinder manufactured by the Reishauer Tool Works, Ltd., Zurich, Switzerland. Designed for universal application for both worm and thread grinding, this machine—with suitable attachments—makes it possible to grind internal threads up to 5 in. diameter and to grind and relief-grind external threads right or left-hand, single or multiple, and to any desired profile.



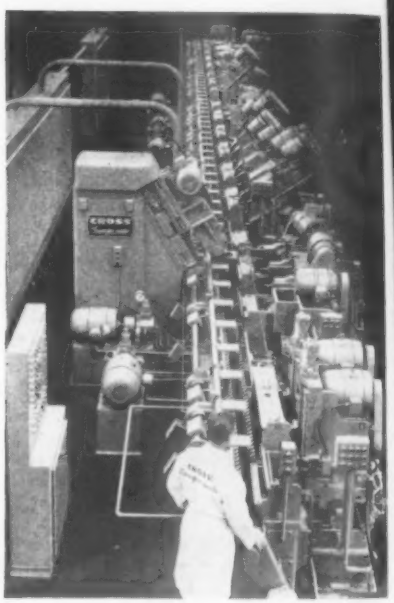
The machine operates on two basically different grinding methods: the longitudinal feed principle for single-thread grinding wheels; and the infeed or plunge-cut principle for multi-thread grinding wheels such as used for production grinding of small taps, thread milling cutters, thread chasers, screws or similar parts requiring ground finishes.

The machine has length capacity between centers up to 28 in., grinds threads to a maximum length of 17½ in. from 0.120 to 8 in. thread diameter and in a pitch range from 60 tpi to 3 in. Wheel speeds are 1550 or 1900 rpm, and the work spindle speeds range from 1.6 to 80 rpm. **T-4-761**

Cross Transfer-Matic

A 90-foot Transfer-matic by The Cross Company, Detroit 7, Mich., drills, mills and taps automatic transmission cases, in 104 operations at a stated output of 86 pieces per hour at 100 percent efficiency.

The machine has 54 stations: 1 loading, 6 milling, 23 drilling, reaming and counter-boring, 2 tapping, 21 inspection, and 1 unloading. As claimed by the maker, only one unskilled operator is required to load and control the operations.



Incorporated in the equipment is the Cross machine control unit, with Toolometer, which automatically stops the machine when any tool requires changing. Readily available pre-set tools reduce downtime. Other features include hardened and ground ways, hydraulic feeds, automatic chip conveyors and use of standard units to facilitate maintenance and provide flexibility for part design changes. **T-4-762**

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

LITERATURE NUMBER	COMPANY	BULLETIN	DESCRIPTION
A-4-128	ADAMS CARBIDE CORP.		Revised "Carbide Manufacturers' Grade Recommendations" helps in selecting proper tungsten steel.
A-4-14	ALLEGHENY LUDLUM STEEL CORP.		"ALX Alloy Tool Bits" helpful information on grinding, tool angles, speeds and other data.
A-4-58	AMERICAN BROACH & MACHINE CO.	No. 450	Thirty-two page catalog of useful, practical broaching information.
A-4-103	AMPCO METAL, INC.		Bulletin stressing cost cutting through use of Ampco's aluminum-bronze alloys.
A-4-119	CHARLES H. BESLY & CO.		Tapping manual contains data on tap selection, application and procedures.
A-4-101	BETHLEHEM TOOL STEEL		"Tool Failures and Their Cure" deals with mechanical causes of failures and their corrections.
A-4-92	BROWN & SHARPE MFG. CO.		Complete catalog on company's line of cutters.
A-4-84	CHICAGO WHEEL & MFG. CO.		Correct sample wheel in response to details of inquirer's operation problems. Also catalog.
A-4-19	THE CINCINNATI SHAPER CO.	B2A	Complete information on company's press brake line.
A-4-4	COLONIAL BROACH CO.	BN-1250	Convenient wall poster of Do's and Don'ts aimed at helping reduce broach maintenance costs.
A-4-90	CRUCIBLE STEEL CO. OF AMERICA		Crucible Tool Steel Selector for choosing proper steel for specific purpose.
A-4-127	DELTA POWER TOOL DIV., ROCKWELL MFG. CO.		"The Power Tool Journal", bi-monthly publication of job data, time and money-saving ideas.
A-4-112-1	THE EASTERN MACHINE SCREW CORP.		"Selecting Proper Die Head for the Job" and other bulletins of pertinent information.
A-4-87	EASTMAN KODAK CO.		Booklet on Kodak Contour Projector presents details on this inspection device.
A-4-143	EX-CELL-O CORP.	No. 35371	Catalog designed to help user pick right bushing to fit the job.
A-4-136-2	GROBET FILE CO. OF AMERICA, INC.	No. HC1	Catalog sheet discusses Grobet chatterless countersinks.
A-4-130	HANNIFIN CORP.	No. 150	"Hy-Power Hydraulics"—28-page bulletin for tool designers and production engineers.
A-4-3	HARDINGE BROTHERS, INC.	CS	Bulletin gives details and price of line of universal collet stops.
A-4-69	HOWE & FANT, INC.		Literature on Lign-o-matic turrets for drill presses.
A-4-2	LANDIS MACHINE CO.	G-94 and G-95	Bulletins stress money-saving features of taps in cutting internal threads.
A-4-122-2	W. F. MEYERS CO., INC.	No. 13	Catalog on savings effected through use of line of bushings.
A-4-95-2	NEW HERMES, INC.	H-41 and IM-41	Literature describes company's heavy duty engravograph and portable engravograph.
A-4-71	O'NEIL-IRWIN MFG. CO.		"Die-Less Duplicating" catalog shows parts produced by this method.
A-4-70	PIVOT PUNCH AND DIE CORP.		Catalog and price list of line of straightground, whipsleeve supported and high-speed steel punches.
A-4-131	SCULLY-JONES AND CO.	No. 10-50	Bulletin shows types, sizes, specifications and prices of line of automatic recessing tools.
A-4-144	THE SHEFFIELD CORP.		Precisionaire Application Book discusses company's precision gages.
A-4-79	SIMONDS ABRASIVE COMPANY		Data book on particulars of Simonds' grinding wheels.
A-4-9	THE L. S. STARRETT CO.	No. 26	Catalog of precision tools; also satin chrome micrometer folder.
A-4-141	WALES-STRIPPIT CORP.	BL and N	Illustrated catalogs on Wales equipment.
A-4-80	WENDT SONIS CO.		Carbide equivalent chart shows carbide manufacturers grade recommendations.
A-4-76	WESSON CO.	SC 151	Bulletin treats company's line of solid carbide blades, stressing advantages.
A-4-6	WINTER BROTHERS CO.		Twenty-page booklet describes various types Winter taps designed for unusual work together with pertinent data.
A-4-104	THE YODER COMPANY		Yoder Slitter Book—76 pages answering questions as to choice of units, production, costs.

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TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

Belts

Folder "How to Choose the Behr-Manning Belt for Your Job" explains company's glue type and resin type Metalite belts, emphasizing uses and most efficient applications. **Behr-Manning**, Troy, N. Y. **L-4-1**

Thread Gaging

"Gaging and Inspection of Threaded Parts" explains uses and discusses details of operations as well as common errors made; drawings and photos supplement explanations contained in text. **The Eastern Machine Screw Corp.**, Truman & Barclay Sts., New Haven 6, Conn. **L-4-2**

Bond, Grinding Wheel

Recently introduced vitrified bond for grinding wheels and mounted wheels, "79E" is described in 4-page folder; outlines advantages and applications of the abrasive development. *Chicago Wheel & Manufacturing Co.*, 1101 W. Monroe St., Chicago 7. **L-4-3**

Vibration Control

Illustrated brochure discusses vibration control engineering, isolators and test equipment and engine mounts; charts are aimed at helping in selection and location of equipment. **The MB Manufacturing Co.**, New Haven, Conn. **L-4-4**

Electric Tools, Portable

Catalog features line of 360- and 180-cycle portable electric tools; includes illustrations and complete specifications. Sales Promotion Dept., **Buckeye Tools Corp.**, Div. 19, 29 West Apple St., Dayton, Ohio. **L-4-5**

Alloys, High-Temperature

Revised "Haynes Alloys for High-Temperature" describes two recently introduced cobalt-based alloys; also contains technical data on 10 specially developed alloys, giving material recommended uses, chemical composition, physical and mechanical properties for each; graphs compare mechanical properities of company's various alloys; also includes age-hardening data and fabrication procedures. **Haynes Stellite Div., Union Carbide and Carbon Corp.**, 725 S. Lindsay St., Kokomo, Ind. **L-4-6**

Multi-Drive Table

Bulletin 85-A completely describes recently developed multi-drive table for rotary sheet metal work; also illustrates various types of rolls used for the different rotary machine operations. **Niagara Machine & Tool Works**, 637-697 Northland Ave., Buffalo 11. **L-4-7**

Production Tools

Line of standard production tools described and illustrated in 11 catalog bulletins replacing company's Engineering Manual 500 and other previous literature. Bulletin 1-50 covers drill and tap chucks; 2-50, arbors and adapters; 3-50, quick change chucks; 4-50, tap holders and drivers; 5-50, counterbores, countersinks, and core drills; 6-50, adjustable adapters; 7-50, sleeves and sockets; 8-50, floating holders; 9-50, centers; 10-50, recessing, and 11-50, work rest blades. **Scully-Jones and Co.**, 1915 So. Rockwell St., Chicago 8. **L-4-8**

Bending, Stainless Tube

Slide chart presents data on desirable minimum radii for economical bending of stainless tubing and pipe from 3/8 to 5 in. O.D. size in B. W. gages from 22 through 11; radii are given for machine bends of 45 to 180 deg. Also contains other pertinent data on sizes, pressures, analyses and properties of stainless tubing. **The Carpenter Steel Co.**, Alloy Tube Div., Union, N. J. **L-4-9**

Hardness Testers

Six-page brochure presents company's line of portable hardness testers; explains and demonstrates use and operation; recommends uses for specific models. **Ames Precision Machine Works**, Waltham, Mass. **L-4-10**

Cleaning, Electrolytic

Revised and enlarged edition of "An Introduction to Electrolytic Cleaning" contains information on fundamentals, differences between various processes, considerations in choice of electrocleaner for particular process and other points included. Industrial Div., **The DuBois Co.**, Cincinnati 3. **L-4-11**

Diamond Tools

Illustrated catalog gives constructive suggestions for proper use of diamond tools, explains formations of diamonds with respect to uses. Lists manufacturers of grinding equipment and recommended diamond tools for use with their various models plus information on how to order. **Precision Diamond Tool Co.**, 102 South Grove Ave., Elgin, Ill. **L-4-12**

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A. S. T. E. NEWS

(Continued from page 64)

Wichita Officer Edits *Tech News* ASTE Issue

Wichita, Kans.—The February *Wichita Tech News*, publication of the Wichita Council of Technical Societies, was an ASTE issue, edited under the direction of Orville B. Strahm, second vice-chairman of Wichita chapter.

Societies represented in the council rotate in editing the *News*. The ASTE number included five stories of national and local activities of the Society.

On January 10 the chapter heard John A. Harrington of the Do-All Co., Des Plaines, Ill. discuss "Line Grinding and Friction Sawing." Examples of line grinding as used in die making and repair were quoted. Friction sawing of stainless steel and other materials was explained, along with the cool grinding process used on the company's surface grinders.

Walter Shannon of the Kansas City Do-All office also was present.

J. James Mudd, representative of The Bellows Co., Akron, Ohio was the speaker at the previous meeting. Mr. Mudd talked on "Use of Air Power in Industry." A sound film illustrated applications.

Mr. Mudd was introduced by Hazen I. Dool, program chairman. D. A. Clem of the Aircraft Products Co. was a guest at this meeting.

Named District Manager

Chicago, Ill.—Walter Zimmerman of Chicago chapter has been appointed district manager for the Columbia Tool Steel Co., with headquarters at Cincinnati, Ohio. He will have charge of the company's tool steel warehouse and office in that city.

Territory in Mr. Zimmerman's new assignment includes southern Ohio, in addition to Kentucky, Tennessee, Alabama, Florida, Mississippi, and Louisiana.

Haller Is Allied V.P.

Detroit, Mich.—Following a stock transaction making the Michigan Powdered Metal Products Co. of Northville a subsidiary of Allied Products Corp., Detroit, John Haller of Detroit chapter has been named vice-president of the Allied concern.

The founder and former president of MPMP, Mr. Haller has asked to be relieved of administrative details to devote his time to research engineering, product development and supervision of production processes.

North East West South in Industry

Release from **Charles H. Besly & Co.** has announced the election of **Norman C. Minehart** as vice-president in charge of the company's abrasive division. At the same time **Jack T. LeBeau** was named manager of the abrasive department. Both men will make their headquarters at the Besly Chicago office.

The **Cadillac Stamp Company** now occupies its recently completed larger plant at 17315 Ryan Road, Detroit 12, designed to meet the company's needs for increased productive capacity.

The **Cross Company** has announced the expansion of its facilities and the addition of 10,000 square feet of floor space through a new Detroit plant, located at 9527 Traverse Avenue, which will be used for the manufacture of small machine parts.

E. Horton & Son Company now is celebrating its 100th year in the lathe chuck industry. The firm has had a continuous and progressive program of design and manufacture since its founding in 1851 by Eli Horton.

Edwin J. Heimer has been appointed sales manager of hand lift and motorized hand trucks of the **Yale & Towne Manufacturing Co.** Mr. Heimer joins Yale & Towne after nearly 30 years experience in the materials handling field.

John C. Redmond, formerly research director of **Kennametal Inc.,** has been elected vice-president in charge of metallurgical development. In this capacity, Mr. Redmond will direct Kennametal's half-million dollar expansion program involving chemical and metallurgical process improvement and new technique development.

A new hot rolling mill will be built by the **Birdsboro Steel Foundry and Machine Company** for **The Carpenter Steel Company.** It will be a combination strip, bar and rod mill and is scheduled to produce material for Carpenter's own cold rolling and cold drawing departments as well as products for direct sale.

The entire business of the **Schoder and Lombard Stamp and Die Company** of New York city has been purchased by **The Parker Stamp Works, Inc.** of Hartford, Conn., thus expanding its facilities to become one of the largest firms in the field.

Herbert L. Schultz has been appointed plant manager of **Mid-West Abrasive Company's** new abrasive grain plant. Mr. Schultz was formerly in charge of layout and engineering for the plant.

At the recent annual meeting of The Aluminum Association, **A. P. Cochran** of the Cochran Foil Company, Inc., was elected president for the coming year. **I. T. Bennett,** Revere Copper and Brass Inc., **L. M. Brile,** Fairmont Aluminum Company, and **E. G. Fahlman,** The Permold Company, were named vice-presidents.

At the **Norton Company's** annual stockholders' meeting held recently, **Edwin E. McConnell** and **Lewis S. Greenleaf, Jr.,** were elected members of the company's board of directors. Mr. McConnell, controller of the firm, who has been with Norton for 16 years, also becomes member of the executive committee. Mr. Greenleaf, who retired from active business January, 1950, formerly was vice president in charge of sales of Durex Corp. and of Durex Abrasives Corp. He also is a director of the John A. Manning Paper Co.

Russell L. Peck, refractories engineer for Norton Company was killed in an automobile accident recently during a business trip through Louisiana. He had been associated with Norton since 1945. **Norman K. Russell,** formerly a member of the refractories sales engineering department at the Worcester, Mass., plant, has been appointed to succeed Mr. Russell.

Coming Meetings

Apr. 10-11, Machine Tool Electrification Forum, sponsored by **Westinghouse Electric Corp.;** William Penn Hotel, Pittsburgh.

Apr. 16-18, National convention of **American Society of Lubrication Engineers,** held in conjunction with 4th annual Lubrication Show; Bellevue-Stratford Hotel, Philadelphia.

Apr. 23-26, American Foundrymens' Society, 55th annual convention; Buffalo.

Apr. 30-May 4, National Materials Handling Exposition; International Amphitheatre, Chicago.

Apr.30-May 11, British Industries Fair; Castle Bromwich, Birmingham, England.

May 15-25, Gauge and Tool Exhibition, sponsored by **The Gauge and Tool Makers' Assn.;** New Hall, Royal Horticultural Society, Vincent Square, London, S.W.1. England.

May 23-24, Fifth annual convention, the **American Society for Quality Control,** Hotel Cleveland; clinics and training sessions, Cleveland Public Auditorium. Cleveland, O.

Abstracts Of

Foreign Technical Literature

By M. Kronenberg

Great Britain: The production of laminated springs for railways has always been regarded as one of the most skilled branches of the blacksmith's art and resulted in the development of a small group of specialists. Post war conditions, however, have brought about a considerable demand for the renewal of car stock of the British Railways which could not be met by the existing resources of industry.

The English Steel Corporation Ltd. has carried out experimental work on a large scale in order to overcome the principal obstacles to mass production of leaf springs, which are mainly due to difficulties in obtaining complete springs of uniform curvature and reasonable uniform deflection.

The investigations by this company are described in an article "Mechanized Production of Railway Laminated Springs" published in *Engineering* of Feb. 9, 1951, and cover the heat treatment, tooling, jigs, presses and final inspection required for bringing about the desired effect. The results of this research which was carried out over a number of years is a plant which has proved itself capable of effecting economies in production and increase in output.

A new application of the Geiger counter, the instrument used in atomic research, for the purpose of tool engineering is indicated in an article published in *Engineering* of February 2, 1951, by C. Wainwright and L. W. Nichols who developed a new method for testing dimensional stability of gages.

Up to the present time, the only practicable method of verifying that a steel gage has actually received a stabilizing treatment has required measurements taken over a long period of time. Steel blanks of high carbon tool steel which are intended for making into gages are customarily heat treated and quenched at about 1470 deg F. They are, however, not dimensionally stable and undergo changes which may amount to as much as 0.0005 in. per inch during twelve months.

The National Physical Laboratory in England has developed a method using the counting and recording of X-ray intensity in terms of electrical impulses, their production rate being proportional to the intensity of the X-rays entering the counter tube through a narrow slit. By means of a Geiger counter attached to an X-ray spectrometer the intensity of X-ray diffraction lines may be measured at different places across the breadth.

It was found in this way that the surface conditions are not affected by a subsequent dry fine-grinding or lapping operation. Dry rough grinding however, causes a modification of the surface conditions due to a momentary overheating of the extreme surface layers.

It is claimed that the Geiger counter method would also be applicable to testing of blanks from workshop production after heat treatment and before machining.

A paper presented before the Institute of Mechanical Engineers and published by E. Johnson in *Machinery* of February 18, 1951, deals with experiments on tapping. This investigation was undertaken in order to ascertain the reasons for tap breakages. Since the cutting action involves a torque on the taps, torsional stresses are produced which were measured on a milling machine adapted for such tapping tests.

The author describes in detail the tests carried out to study the effect of cutting speed, the effect of swarf on the torque, the effect of the taper of the tap, surface finish of the tap, lubrication, holding of the tap, and so on.

He came to the conclusion that cutting speed has little effect on the torque and does not affect either the surface finish or the accuracy of the threads. Chips, however, must be cleared out of the flutes as quickly as possible. He concluded furthermore that grinding the taps improved their tool life and the produced threads.

Switzerland: A review of the development of milling research and design of milling machines in Europe appeared in #11/1950 of *Industrielle Organisation*. The author, A. Duerr, indicates that the present development in milling is not the result of invention of new tool materials but rather the effect of practical application of metal cutting research.

The article contains numerous diagrams referring to specific cutting force, tool life, cutting speed—some of them quoted from American publications and compared with European data. It is interesting to note that tests run at the author's company confirm the existence

of a critical maximum for super-high-speed cutting, which was originally discovered in 1931 and revealed in the Krupp-Salomon patent.

Oscillographs covering variations in cutting temperature in milling as measured at the workpiece are likewise included, showing temperature variations up to 2100 cycles per second. Destruction of carbide tips by vibration is shown by microphotographs. Numerous examples of milling machines and hydraulic drives complete the article.

Germany: The critical maximum for super high speed cutting which was discussed in the article by A. Duerr, is also among the topics of a paper by W. Reichel published in the December 7, 1950 issue of *Stahl & Eisen*, dealing with measuring temperature in the drawing of rods and wires.

The author indicates that temperature measurements made when drawing wire and rods can also be used for determining optimum tool design, tool life, and other data similar to the determination of such items from temperature tests when machining metals.

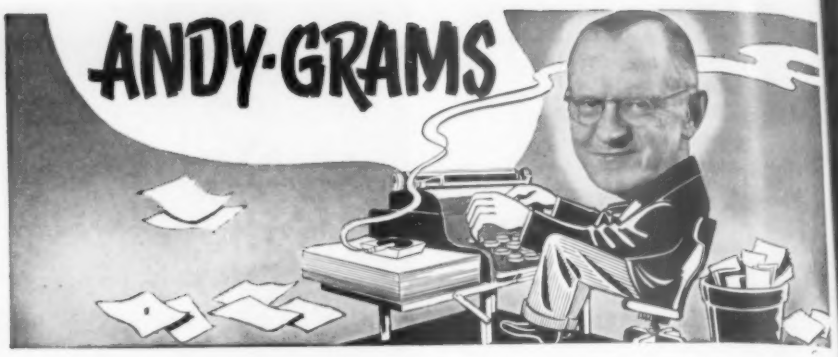
The author suggests to use either thermocouples or the so called "two tool method" for determining the temperature existing at the tool-workpiece interface when drawing wire. He assumes that a similar phenomenon may exist in the temperature rise and fall with increasing drawing speed, as in the case of cutting metals, at increasing cutting speeds.

The relationship between the width of wear on the flank of a carbide tool and the admissible cutting speed has been investigated by H. J. Burmester, and published in *Werkstattstechnik und Maschinenbau*, December, 1950.

While the end of the useful life of a high-speed steel tool can usually be concluded from the appearance of a burnished surface on the work, such simple criterion does not exist in the case of sintered carbide tools. Industry has therefore adopted an arbitrary criterion, namely the width of the wear land. The shortcomings of such method are well known, but, according to the author, no change in method seems to be possible because the wear land is relatively easy to measure and therefore does not involve substantial cost when running tool life tests.

In the article it is claimed that contradictions in tool life based on such tests may be due to two different types of wear namely, the rubbing action of the work on the cutting edge, and the oscillations of the cutting force. The author has developed several formulas which may overcome, to a certain extent, the poor accuracy obtained from tool life tests based on the width of the wear land only.

ANDY-GRAMS



Well, the '51 Annual is now history, but of that more later a/c we had to go to press ahead of the Convention due to a change in publication date. Anyway, I hope you all had a good time and that, for those who sailed, the Bermuda cruise wasn't marred by hurricanes and *mal de mer*. So for now, another letter re the Tea Can:

Dear Andy:

I have been touring India for the past several months and on return to Bombay arranged for a quiet hour to read The Tool Engineer. I was puzzled with your remarks in AG's, October '50 issue, when you queried my remark about the Tea Can and said that you were withholding the writer's name. Actually, Andy, I suspect the word "can" had a lot to do with it, if you know what I mean. I was pleased to note that you had asked an explanation and that there are other fellows with knowledge of old-time tricks.

Tell Bob Kerr (Philly chapter) that I am from Birmingham—known as "Brummagam"—and I am therefore a Brummy which is distinct and apart from the characters known as Limeys or Cockneys. I believe that the tea can trick was also played in the North, where machine tool engineers would jokingly ask for a "Brummagam screw driver" when a job called for a heavy hammer. However, we took that in good part when installing machinery in that section.

To give you a bit of local color, out here it is always interesting to see a new machine installed in a factory. A particular ceremony is performed, called a "pooja", whereby the machine is blessed . . . along with the company and the worker. The machine is also bedecked with flowers and the operator usually gets about Rs.50/-. All the workers are given sweets and soft drinks as well; on the whole a most impressive ceremony and I have sat in on a number of them.

Referring back to Bob Kerr, I like his story about the Blacksmith and the Sandwiches. His sketch of the Tea Boy is perfect! That job always carried a useful extra couple of bob which came in handy when buying spares for our souped-up motor bikes, known as crates. All for now, Andy. I am preparing for a trip back to the U.K. via Switzerland, where I hope to see some very interesting single-spindle automatics at Tarex Machine Tool Co. Ltd., Geneva.

With best regards
R. Jenks

Well, if I don't get around personally at least the world comes to me like Mahomet to the mountain or vice versa. As for keeping Ralph Jenks anonymous, that was just a teaser to invite letters—and oh, did they come! Oh well, the Column was started in the first place to promote Society growth and to foster that friendliness which was the keystone of the ASTE.

I believe that my page has met its intended purpose; anyway, letters from members in India, Australia, Africa, the Continent, South America and wherever tool engineers work to enhance the design for living tend to knit the Society into a unified force for good. In this connection, I am wondering about one of our "gadgeteers"—Federico Strasser of Santiago de Chile—who, last Christmas, remembered me with a unique greeting. Can't seem to find him either in our mailing list or membership roster. How about joining up, Federico?

As I have previously intimated, the ASTE has long since become a fount of know-how in the making of things, and while we can't answer all questions—as, for example, who patented what and when?, which we refer to the Patent Office—we usually try to come across even if the "impossible" takes a little longer. Apropos which an excerpt from a recent letter:

Dear Sir:

As a regular and interested subscriber to The Tool Engineer and a member of ASTE Toronto chapter, turning to you seems to be a logical move when technical information is required. . . . May I add at this point that I am finding The Tool Engineer increasingly interesting and without doubt it leads the field of comparable publications in the down-to-earth technical information.

Yours very truly,
William Bogey

* * * * *

In common with many of our members who had the pleasure of knowing him, I am saddened by the passing of John Nelson, a tool engineer of the old school whose know-how of tooling for mass production was only exceeded by a self effacing modesty. A

man of few words—but oh, how they counted!—we will remember John for his warm friendliness and innate kindliness, and a laugh that was as infectious as it was inimitable. In memory of an old friend, then, turn down an empty glass.

* * * * *

A call from Gene Bouton, convener of Racine chapter, with greetings from his and Milwaukee chapters. Active in war production during World War II, Gene is now sub-contracting engineer with the Massey-Harris Company of Racine. Well, the company got itself a good man and so congratulations to both.

A look-see from Bill Jarvis of Chas. L. Jarvis Co., Middletown-on-the-Connecticut, now slated as technical Sessions Ch'man at the Annual. Knew they'd put him to work sooner or later. A clipping from Boston's John Sylvester, showing the latest in etiquette in Providence, R.I. Reminds me of the time when, as a youngster, I tipped my hat to a girl while riding a bike, struck a stone and flopped in the mud. Pride going before a fall!

Also, a visit to H.Q. by Bob Brunner, son of Ray Brunner who, for several years, served the Society as Nat'l Secretary, and Jopling Smith of Houston chapter. I introduced the boys to the Lost Weekend, as I have titled the monster I captured (not alive) up in the north woods a few years ago, along with the Galloping Wimpus and the rest of my menagerie. I mention the latter a/c on making up the page I find myself a few lines short and so have to fill an aching void.

From one thing to another, a lot of things seem to come too late in my life, apropos which I see by the papers where they've discovered a hormone for growing hair on bald pates and only in the right places. Only, they ain't going to put it on the market for a while, so what good does it do me? At that, I'd like to see my formula worked out on some obliging guinea pig. The idea is that you take a hair, bend it and stick the loose end in your scalp. Then when it takes root you snip it in two and there you have two hairs where only one grew before. Anyone desperate enough to try it please let me know results—if any. And that will be all for now; see you next month maybe.

ASTEely yours

Andy

Technical Shorts . . .

Two motion picture films, designed to teach gaging fundamentals and modern practice, are available from the Federal Products Corporation, 1144 Eddy St., Providence, R. I.

"The Dial Indicator" shows in detail the principles of direct and of precision measurement and also explains tolerances and their applications to mass production.

"Dial Indicator Gages" demonstrates how dial indicator gages are used to control dimensions of interchangeable workpieces produced by mass production methods. Demontrations explain in detail the purpose, proper use and handling of the gages. Scenes in modern shops where precision gaging is of importance illustrate inspection problems.

Both films are combined on one reel to facilitate showing, with showing time running about forty minutes.

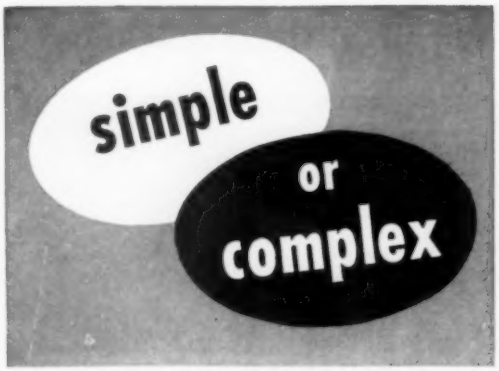
As part of a program to provide a modern, effective curriculum on industrial engineering, Stevens Institute of Technology has increased its laboratory facilities to allow students practical experience in the use of time and motion study and other industrial engineering techniques, and where they may learn to apply these methods to operations run under actual factory conditions.

A feature of the laboratory will be the application of modern statistical procedures for treating time and motion study problems, including random sampling for estimating production rates and delay percentages, and for establishing standard time values for operation elements and motion.

A recently published revised edition of the American Standard Abbreviation for Use on Drawings, Z32.13-1950, will aid draftsmen, shopmen, assemblers and construction men to interpret industrial drawings from various companies or government branches with its up-to-date information on the latest industry-wide practices.

This edition contains special sections on abbreviations for colors, valves and screw threads.

The volume, which was developed jointly by the American Institute of Electrical Engineers and the American Society of Mechanical Engineers under the procedures of the American Standards Association, is available from the Association's headquarters, 70 East 45 St., New York 17. **$1.**



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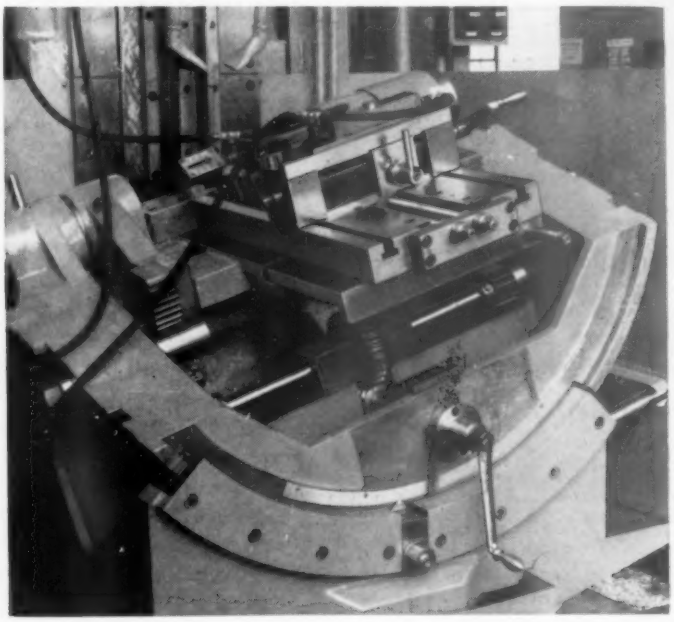

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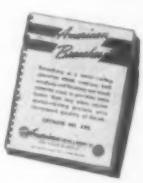

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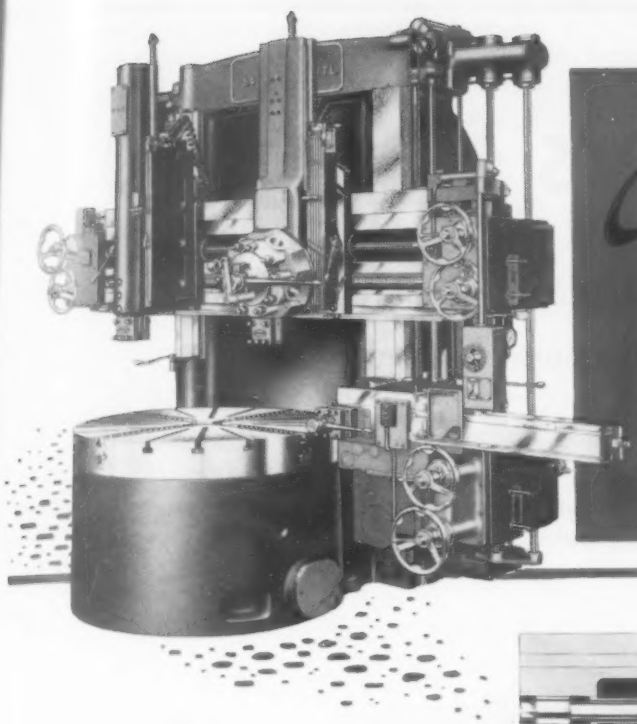

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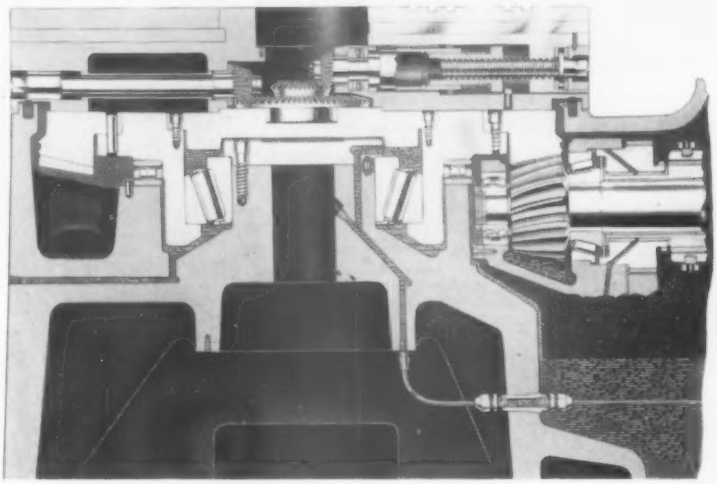

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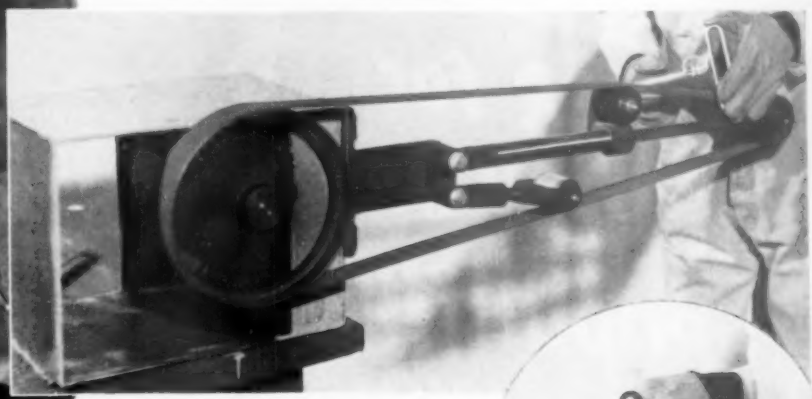

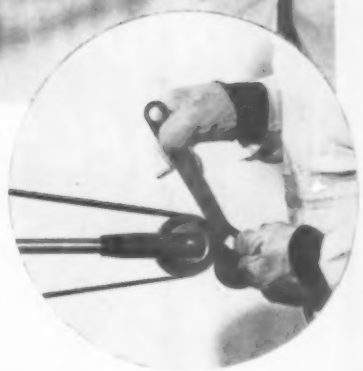

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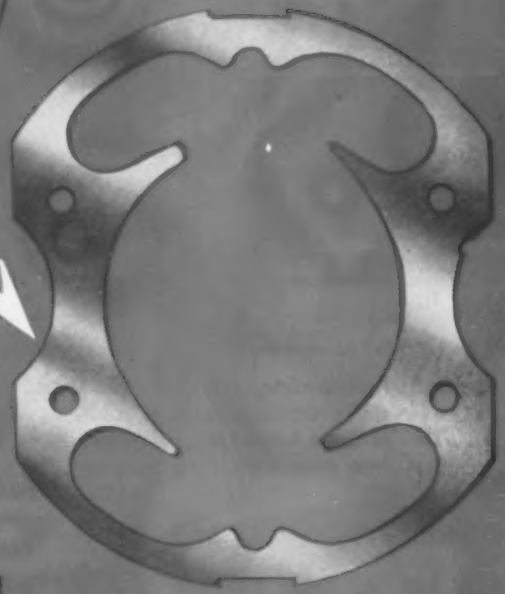

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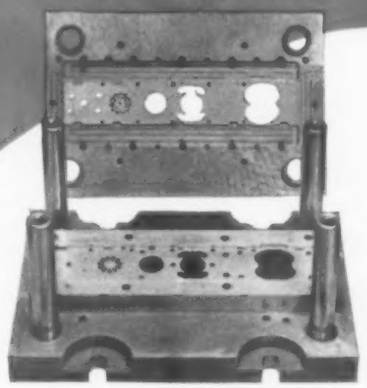

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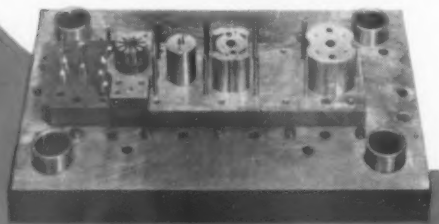

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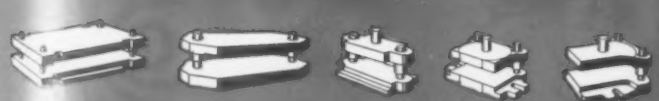

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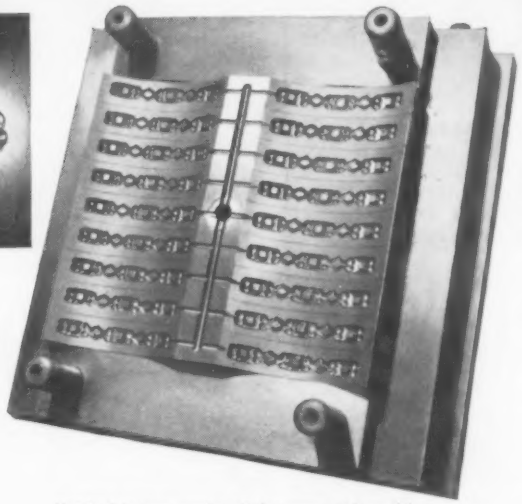

Hobbed in one stroke of the press, this mold is a fine example of intricate detail. Made from Duramold A, it produces injection-molded barrettes.

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When steels are being heated in the critical range prior to quenching, they are weak . . . and will sag or flow plastically unless supported properly. In heating tools that have sharp corners, an unbalanced design, or thin sections—it's important to heat slowly and uniformly. And be sure that proper mechanical support is provided during the heat.

Safecrackers Foiled by Carbon Tool Steel

A manufacturer of safes couldn't seem to get a suitable grade of steel for clamp bolts in tool-proof safe doors. The bolts needed a tough body to resist snapping when torsion is applied in clamping together a series of heavy, laminated tool-proof plates which make up a safe door. The bolts also had to be very hard on the butt end so that ingenious burglars, who are familiar with the exact location of these bolts, are foiled when attempting to drill holes through the bolts to place explosive charges.

After heat-treated alloy and special steels failed to do the job, Bethlehem carbon tool steel, heat-treated in a simple end-quench fixture, turned the trick.

The customer ordered annealed, shallow-hardening carbon tool steel which meant easy machining of the threads. The machine bolts were then heated all over to optimum quenching temperature. The butt end of the bolt was end-quenched similar to a Jominy test bar. This resulted in a hardened chill at the butt end of about Rockwell C-62 after a low draw. And along the threads the body was tough—about Rockwell C-30.

The exacting combination of properties required for this application could be obtained only by the closely controlled hardenability characteristics of our shallow-hardening carbon tool steel.

Ask Us for Free Treatise on Tool Failures

Basing his facts on investigations of several thousand tool failures, one of our tool-steel engineers has written a practical discussion which should help every user of tools to increase his batting average. Entitled *Tool Failures and Their Cure*, the first portion deals with mechanical causes of failures, such as poor tool design, improper grinding, and many other factors.

Problems dealing with faulty heat-treatment and distortion are also described in some detail. The author tells how to make good tools and offers many practical suggestions to avoid the troubles usually encountered in toolmaking.

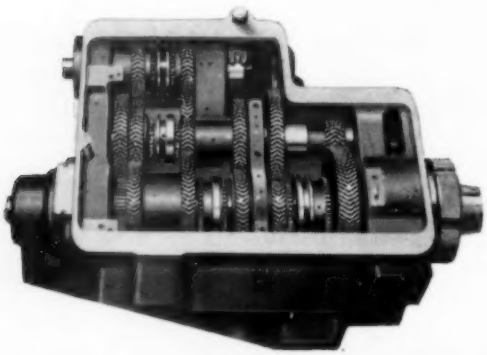
Added interest is provided by a number of photographs which illustrate various types of failures. Originally published in installments by *Metal Progress*, this helpful treatise is now available in reprint form. Address your request to our Publications Department, Room 1041, Bethlehem, Pa.

Bethlehem ULTRASONIC TESTED **Tool Steel**

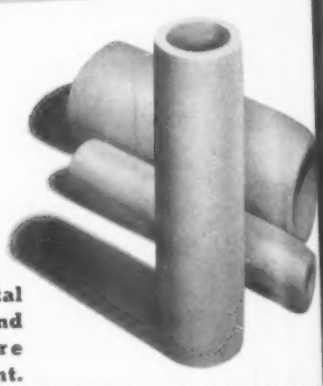
Tumbling Barrels . . to Resist Corrosion and Abrasion. These barrels are subject to extreme wear from small parts being cleaned by the swirling agitation of caustic solution and abrasives. For extra-long life, they are fabricated from wear- and corrosion-resistant Ampco Grade 8 sheet, carbon-arc welded with 5/32" Ampco-Trode 160 coated electrodes used as filler rods.

Ampco Extrusions available as olid rod and/or tube rounds or simple shapes. From co's own 2275-ton draulic press and extrusion mill, use saves metal, chining time, and costs. Superior ain structure and tionally high strength are assured — *plus* close tolerances good surface finish.

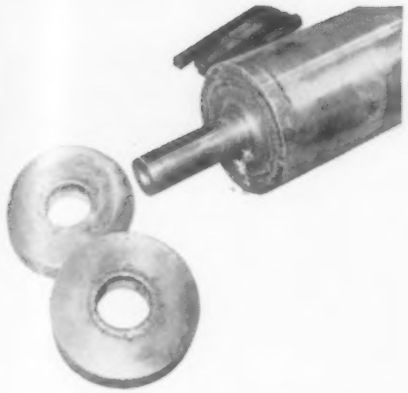
Ampco Metal Cam . . . for Smooth Action, Extreme Wear-Resistance. Ampco Grade 20 selected because it actually outlasts hardened steel with twice the Brinell hardness. This is due to its extreme wear-resistance and the smoother action of bronze against steel. Also ideal for rollers, gibs, slides, wearplates, forming dies on light-gauge steel and welding jaws.



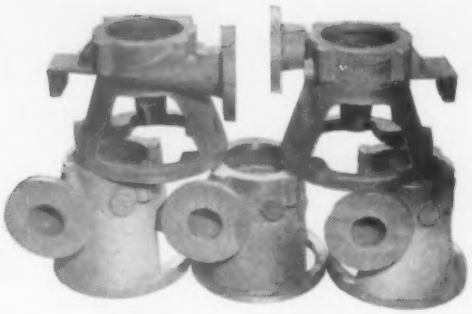
Ampco Bushings on High-Speed Headstock . . . for High Wear-Resistance. There are 16 Ampco Grade 18 Bushings in this one headstock: 14 on loose-running gears, 2 on the center bearing of the intermediate shaft and main spindle. Ampco Grade 18 chosen as ideal alloy because of the heavy gear loads and high spindle speeds. Extra life assured by high tensile (77-85,000 psi), and Brinell hardness of 159-183.



Stock Bars of Grade 18 Ampco Metal . . . for Production and Maintenance where long life is important.
Wear-resistant. Have exceptional impact and fatigue characteristics. Centrifugally cast to provide dense, fine grain structure free from impurities. Readily machinable. Ideal for bearing bushings, gears, worm wheels, slides, guides and other wear applications. Available from stock in 12½-inch lengths from 2½-inch to 6-inch OD, or solid bars ½" to 4½" diameter, cut to desired lengths.



...er Mill Rolls . . We... Resistant for Longer Service. ...ght and wear are ...sual problems in such rolls. Both ...e licked in this case ...with Ampco aluminum-bronze. Centrally-cast Ampco Metal Grade A-3 provided a light, hollow ...r — resistant to both wear and corrosion. Shaft and end-...es were cast of the same alloy and welded to the roller ...h corrosion-resistant Ampco Trode 10 electrodes.



Cast Ampco Metal Pump Bodies . . . for Corrosion-Resistance. Ampco Grade 12 selected for its high resistance to corrosion and wear (which is a special quality of all Ampco Metals). Grade 12 also has the advantage of quick, easy seating for valve and pump parts. Meets Federal specification QQ-B-671a, Class A, and Navy specification 46-B-18c.

AMPCO®

...Equipment Life--Lower Costs with AMPCO Bronze Parts

Specify Ampco aluminum bronze for these unique, money-saving properties:

1. High tensile strength
2. High compressive strength
3. High impact and fatigue values
4. Excellent bearing qualities
5. High "strength to weight" ratio
6. Resistance to wear and corrosion
7. Good retention of values at temperature extremes

It pays to use Ampco aluminum bronzes wherever you can. These long-wearing bronze alloys assure longer life and better service for almost any part — reduce maintenance and replacement frequency, cut downtime losses to a minimum!

First of all, be sure to specify Ampco bronzes for your own products. They're a mark of extra-quality which all buyers recognize. By the same token, look for Ampco bronze parts as a mark of extra-value in the equipment which you buy. And of course, use Ampco bronze replacements in your own plant maintenance to reduce downtime, service and repairs, and to insure low-cost, trouble-free operation.

Make Ampco Bronze Parts a "must" in every plan — product or production. That way you're sure of lower costs. Send for complete information today.

...Ampco aluminum bronze and other ...Ampco copper-base alloys are avail-...able in a variety of grades to meet ...your exact requirements in any form ...you need: rolled sheet or plate, sand ...or centrifugal castings, forgings or ...extrusions, arc- and resistance-weld-...ing electrodes, and corrosion-resistant ...centrifugal pumps and plug valves.

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Cost-cutting information! Tear out this coupon and mail today.

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Send me your free Bulletin giving full details of cost-saving physical properties of Ampco aluminum-bronze alloys.

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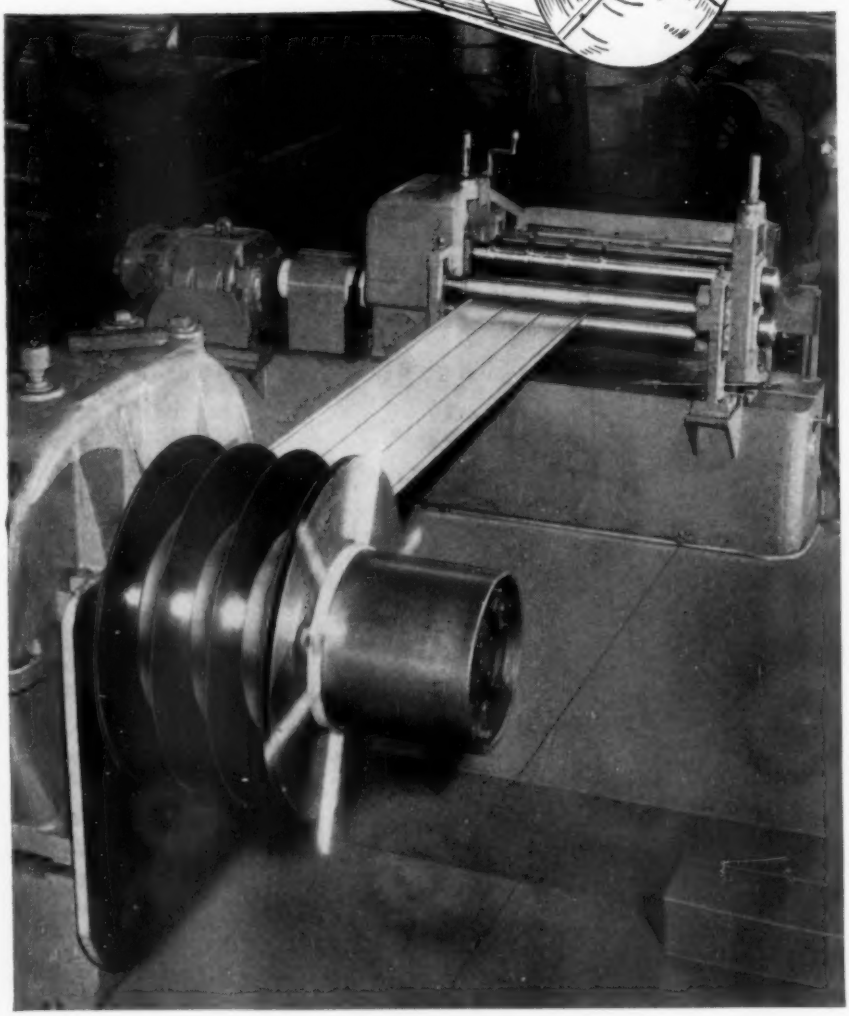
p-4

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A4-103

Big Tonnage Not Necessary

To Make YODER Slitters Profitable



Producers and users of big tonnages of coiled strip and sheets usually find a Yoder slitting line will pay for itself every three or four months. Fabricating shops using moderate tonnages often find the slitter pays for itself in a year or less, operating only one or two days per week.

The difference between the cost of standard widths and slit-to-width coil stock varies all the the way from $10.00 up to $100.00 or more per ton, depending on width of strands, gauges and quantities. Even on annual requirements of less than 1000 tons, doing your own slitting may, therefore, pay very handsome dividends on the slitter investment. Equally important is the *convenience* of having your own slitter. Production planning is simplified and strip inventories may be reduced 50% or more by buying mill-edge stock in the required gauges, slitting it yourself to required widths when and as needed.

Yoder Uncoilers, Slitters and Recoilers have been standardized in a large number of sizes and capacities, from the smallest up. Investigate the economies of doing your own slitting with a Yoder line made up of units best suited to your requirements. Send for 76-page Yoder Slitter Book. It answers many questions as to choice of slitting units, production, first cost and operating cost.

THE YODER COMPANY • 5525 Walworth Avenue, Cleveland 2, Ohio

Complete Production Lines

- ★ COLD-ROLL-FORMING and auxiliary machinery
- ★ GANG SLITTING LINES for Coils and Sheets
- ★ PIPE and TUBE MILLS–cold forming and welding

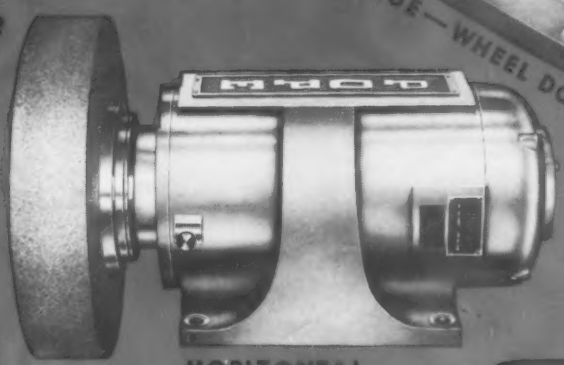
ENGINEERING YODER MANUFACTURING

Specify POPE

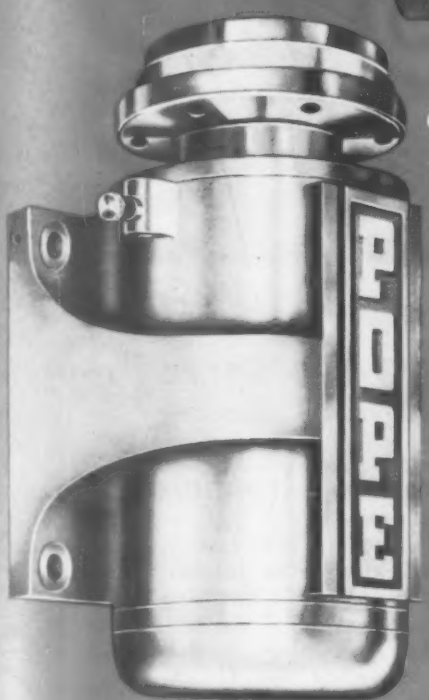
2500 SERIES—HEAVY DUTY MOTORIZED SPINDLES

OBLIQUE—WHEEL UP

OBLIQUE—WHEEL DOWN



HORIZONTAL

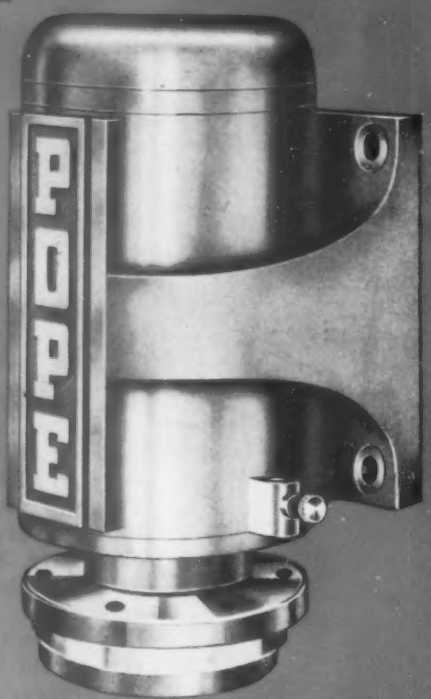


VERTICAL—WHEEL UP

OPERATING POSITIONS

These P-2500 Series Spindles can be operated in any position . . . vertical, horizontal or at any oblique angle.

It is necessary, however, that the operating position be specified in your order.



VERTICAL—WHEEL DOWN

No. 76

POPE

TRADE MARK REG. U.S. PAT. OFF.

POPE MACHINERY CORPORATION

ESTABLISHED 1920

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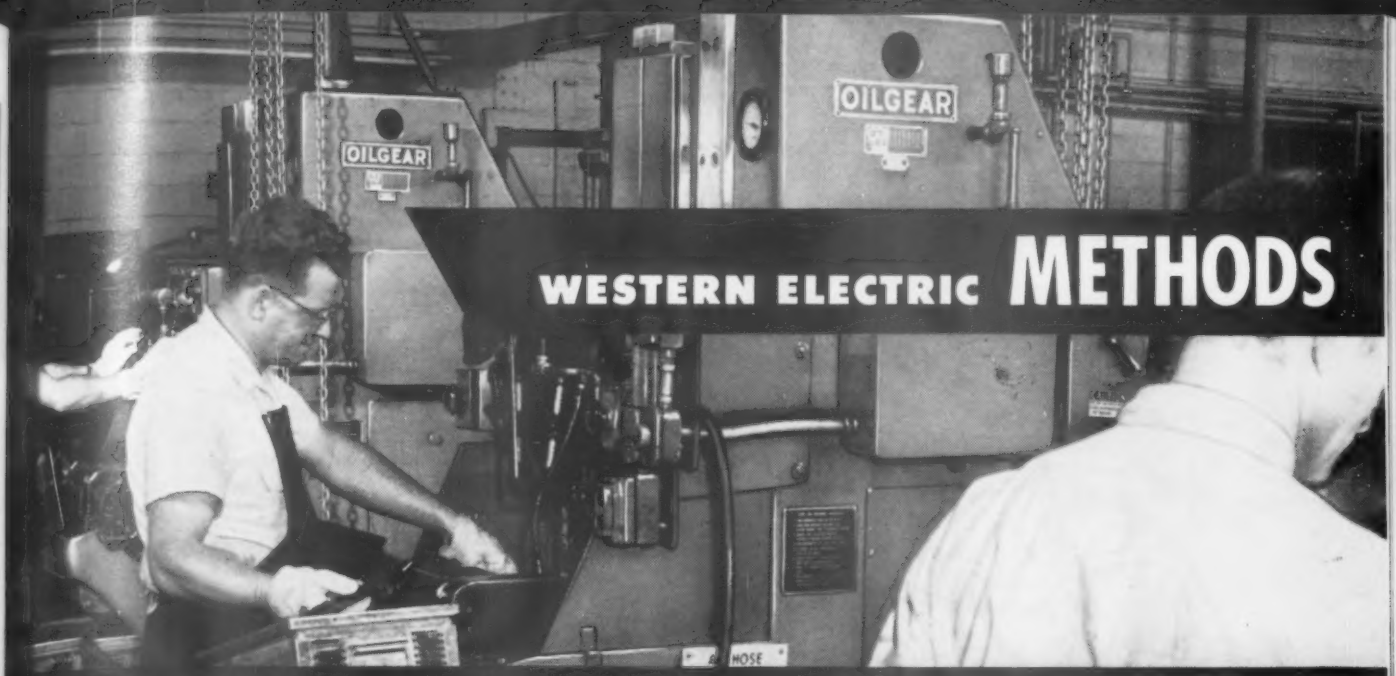
BUILDERS OF PRECISION SPINDLES



WESTERN ELECTRIC METHODS

:LUDE OILGEAR MACHINES FOR BROACHING STAMPINGS

7 OILGEAR VERTICALS AT CHICAGO

The Western Electric Company, outstanding in the manufacture of all types of telephone equipment, has used Oilgear Broaching Machines since 1928. Some of the Vertical Surface Broaching Machines shown above have been in service more than 10 years. The machines in the upper panel finish broach four edges on stampings for crossbar switches. Production for each machine is in excess of 600 pieces per hour. The Oilgear Verticals in the lower panel finish broach two knife edges on steel stampings used as the armatures of crossbar relays. Here too production from each machine is more than 600 pieces per hour.

Oilgear Broaching Machines offer you many advantages as standard which are exclusive with Oilgear or are to be found elsewhere only at extra cost.

Oilgear Machines are often bought to replace other types of equipment and represent tremendous gains both in initial savings and in greatly increased production. This is true in the case of small factories where every capital investment must be carefully made, and in the case of large industrials where production is largely given over to semi-automatic and fully automatic machines, and unfailing dependability becomes just that much more vital. It will pay you to investigate what Oilgear Broaching Machines can do for you. THE OILGEAR COMPANY, 1573 W. Pierce St., Milwaukee 4, Wisconsin.

OILGEAR

Oilgear

PIONEERS IN FLUID POWER

BROACHING MACHINES AND PRESSES

PRODUCTION jobs are not delayed where Red Shield Drills are used. STANDARD tools are uniform in construction and operating characteristics. Their production is fast—economical—dependable.

Standard "Red Shield" Service Men are always available to give you the benefit of our 70 years' of accumulated experience in mastering tough cutting tool jobs.

STANDARDIZE and save on drills, reamers, taps, dies, milling cutters, end mills, hobs, counterbores, and special tools. Sold by leading Industrial Supply Distributors coast to coast.

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THE STANDARD LINE: *Drills • Reamers • Taps • Dies • Milling Cutters • End Mills • Hobs • Counterbores • Special Tools*

You cut costs as well as metal...

with UNION *end mills*

UNION DOUBLE-END END MILLS are available with four flutes — as illustrated — or two flutes, in standard or small-diameter sizes. All in high speed steel.

BUILT FOR MAXIMUM ECONOMY, Union end mills provide top performance throughout the range of end milling operations. Made of high speed steel, they have the smooth, free-cutting action that saves power, while their great strength reduces breakage to a new low. And all Union solid type end mills of ½" diameter or over have deep counterbores, considerably lengthening their resharpening life. In fact, as with all Union cutting tools, every detail of their design and construction is the result of up-to-the-minute tool engineering that saves you time, labor and money . . . *And that's worth specifying!*

THERE'S A TYPE OF UNION END MILL FOR EVERY PURPOSE

Taper Shank	**Single End**
Straight Shank	**Double End**
Shell	**Ball End**

Union is also prepared to make special types of end mills to your specifications.

no other end mill will outperform a UNION

contact your local distributor

His name is listed in Union's THOMAS' REGISTER insert under "Drills, Twist."

UNION TWIST DRILL COMPANY, ATHOL, MASSACHUSETTS

Milling Cutters · Gear Cutters · Twist Drills · Hobs · Reamers · Carbide Tools

We own and operate S. W. CARD MANUFACTURING CO. Division, Mansfield, Mass. Taps, Dies, Screw Plates . . . BUTTERFIELD DIVISION, Derby Line, Vt., Taps, Dies, Screw Plates, Reamers . . . BUTTERFIELD DIVISION, Rock Island, Que., Milling Cutters, Twist Drills, Hobs, Reamers, Taps, Dies, Screw Plates.

H&G DIE HEADS

WITH INSERT CHASERS

FOR ALL MACHINES USED FOR CUTTING SCREW THREADS

The famous H & G Die Heads come in styles and sizes for all types of machines, including threading machines, chucking machines, drill presses, turret lathes, and automatic screw machines, such as Brown & Sharpe, Cleveland, Cone, Davenport, Economy, Foote-Burt, Greenlee, Gridley, Acme-Gridley, New Britain, New Britain-Gridley, Swiss, etc.

The small, inexpensive high-speed steel insert chasers are held by rugged carriers and cut threads straight and true to the close tolerances required.

The majority of expert production men prefer these die heads because of the ease with which insert chasers are resharpened and set, the low cost of insert chasers and the greater quantity of threads per grind and number of pieces threaded per chaser dollar.

The reduction in inventory will pay for new die heads. **For example:** If you have $1,000 in chaser inventory, changing to H&G will require only $300, setting free $700 for the purchase of new H&G heads. This is due not only to low cost of chasers, but to interchangeability and long life.

Check and Mail for Free Copy ☐ "Selecting Proper Die Head for the Job" ☐ Style MM ☐ Style DMS ☐ Style DM ☐ Style TM

THE EASTERN MACHINE SCREW CORPORATION

27-47 BARCLAY STREET NEW HAVEN, CONN.

Mfrs. General Purpose Die Heads, Insert Chaser Die Heads, Threading Machines.

USE READER SERVICE CARD; INDICATE A-4-112-1

RUST

The biggest THIEF in America

ALL through the summer—through hot, humid days and hot, humid nights—the biggest thief in America will be raiding your plant. Wherever steel is handled—where it is stamped and milled or machined or ground, where it is pickled or cleaned or assembled—RUST will be busy, robbing you of production, robbing you of profit.

But you don't have to put up with this thievery. Your Oakite Technical Service Representative can help you defeat RUST. He has methods and materials for:

1. **Removing rust and grease in one operation**
2. **Preventing rust while parts are being processed**
3. **Cleaning and conditioning for painting in one operation with protection against rust before and after painting**

FREE For help in arresting RUST in your plant, write to Oakite Products, Inc., 18H Thames St., New York 6, N. Y.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

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BETTER CHECK...

RUTHMAN GUSHER MACHINE TOOL COOLANT PUMPS

Gusher Coolant Pumps give you everything you're looking for in a coolant pump.

Split-second coolant control, from a trickle to full volume with no packing or priming needed, helps you raise production on your machines.

Simple yet sturdy construction with dynamically balanced rotating parts assures you of long trouble-free life.

Heavy-duty pre-lubricated ball bearings which require no further lubrication or attention cuts maintenance costs to a minimum.

Follow the leading machine tool manufacturers—specify Gusher Coolant Pumps on your metal-cutting machinery.

THE RUTHMAN MACHINERY CO.

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ASK **BAIRD** ABOUT IT!

HIGH PRODUCTION TOOLING

3820
4521

BAIRD 54 VERTICAL LATHE showing splash guard for wet operation

4 SPINDLE VERTICAL LATHE

with Continuously Revolving turret

. . . ELIMINATES NON-PRODUCTIVE INDEXING TIME

The Baird 54VC lathe was designed for dry or wet cutting of light jobs, boring piston ends, facing, turning bands, ogives, etc. In this specific job, a Pump Rotor was finished on the O.D. and both faces finish turned and chamfered. The tools feed both on the in and out of the cutting stroke. Work is held on an arbor type holding fixture.

The turret, carrying 4 work spindles and 4 sets of tool bars, rotates at 32 seconds per cycle. Thus, one part every 8 seconds . . . 450 pieces per hour. Stock removal is approximately .012" on O.D. and .010" on faces.

Photograph at right shows actual size of pump rotor. See above for operations performed.

The turret is driven through worm and gears . . . spindles mounted in roller bearing and driven by helical gears. Changes in all speeds are easy and inexpensive. Control stations are within easy reach, the spindle control at left; control at right for turret and tool arms . . . protected to prevent feed of tools to work unless spindles are revolving. All electrical equipment is enclosed, with wiring concealed. The Baird 54 Vertical Lathe is a most versatile machine . . . and a profitable one for work within its range . . . so "ask Baird about it."

the BAIRD MACHINE COMPANY
STRATFORD • CONNECTICUT

AUTOMATIC MACHINE TOOLS • AUTOMATIC WIRE & RIBBON METAL FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

3BA51

ON COLLET CHUCKS WITH UNIVERSAL'S SIMPLER DESIGN

Universal's collet chuck design with only three basic parts — nut, collet and chuck . . . means lower initial cost and less need for replacements because there are less wearing parts. This design not only saves money — it also provides wrap-around action, gripping on a continuous surface *the full length of the collet.* Drills can't slip, tool shanks don't get scored, tools run true and run-out is held at a minimum. Universal Collet Chucks are *available from stock* in collet sizes from 1/16" to 1½", to fit any screw machine. To cut chuck costs, write to the Universal warehouse nearest you . . . 1060 Broad Street, Newark, N. J., 5035 Sixth Ave., Kenosha, Wisc., or the home office.

Exploded view of Universal Collet Chuck illustrating simplicity of design

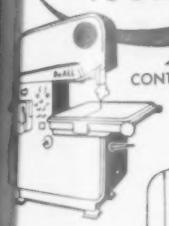
OTHER UNIVERSAL PRODUCTION TOOLS

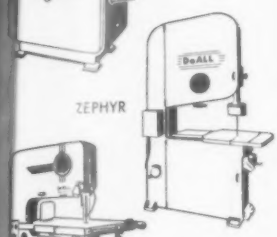
UNIVERSAL ENGINEERING COMPANY

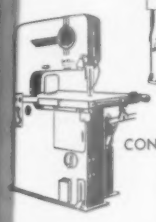
FRANKENMUTH 3, MICHIGAN

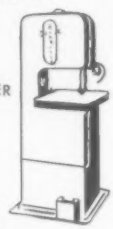
149

DoALL
INDUSTRY'S NEW SET OF TOOLS


CONTOUR-MATIC

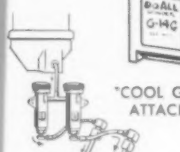

ZEPHYR

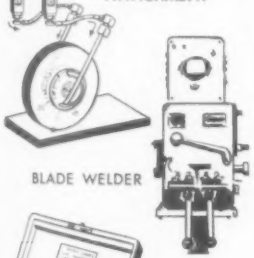

CONTOUR


BAND FILER

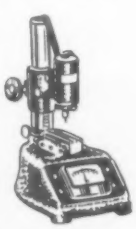

TOOLROOM GRINDER

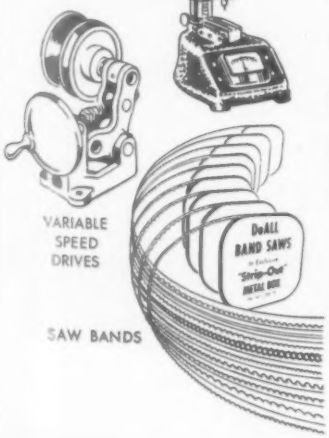

CRUSH GRINDER


"COOL GRINDING" ATTACHMENT


BLADE WELDER


GAGE BLOCKS


GAGE ACCESSORIES



VARIABLE SPEED DRIVES

SAW BANDS

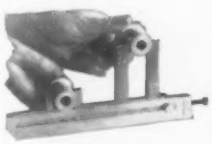
IT'S IMPOSSIBLE to have GOOD INSPECTION without GAGE BLOCKS

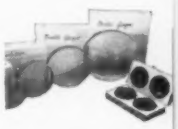
Your Plug Gages, Ring Gages, Snap Gages, Dial Indicators, Comparators, Micrometers, and other shop measuring tools cannot measure accurately unless they are used with, and regularly checked against, a reliable set of Precision Gage Blocks.

The only way Gage Blocks are an expense is when you don't have them to use. Without them, you lose more than many times their cost in rejects, material and labor.

DoALL Gage Blocks and Accessories are the best in the world today. Our Gage Specialists can prove it to you. Write for proof today.


DoALL MOBILE INSPECTION UNI contains a completely integrate set of Precision Inspection Tool


Gage Block Holders


Optical Flats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TOOL STEEL


BENCH FILER

The DoALL Company
Des Plaines, Ill., U.S.A.
Cable Address: DoALL, Des Plaines

DoAll Stores In Key Cities

Factory Trained Representatives Everywhere

THIS SIMPLE WELDING OPERATION SAVED A LOT OF TIME AND MATERIAL ! ! !

Male flanging die section rebuilt with TOOL-ARC Oil Hardening electrodes. Rockwell "C" hardness 60 to 62, as welded.

TOOL-ARC Conserves Material, Saves Manhours Minimizes Production Delays . . .

Six Basic Types

TOOL-ARC
Oil Hardening
TOOL-ARC
Water Hardening
TOOL-ARC
Air Hardening
TOOL-ARC
Hot Work
TOOL-ARC
High Speed
TOOL-ARC
Work Hardening

TOOL-ARC electrodes are made by the extruded process to assure uniform coating thickness concentric with the core wire. Result — finer quality weld with greater dependability. These electrodes will deposit tool steel weld metal of any one of six basic types and provide characteristics typical of each type.

FOR:
- Engineering Design Changes
- Rebuilding Worn Tools and Dies
- Composite Fabrication of New Dies

Prolong the life of your tools and dies by refacing with TOOL-ARC. For complete description, properties and welding procedures, ask for Bulletin No. 2519.

"I Like the rod that comes in the RED can"

SEE YOUR NEAREST ALLOY RODS DISTRIBUTOR

ARCALOY for stainless steel
NICKEL-ARC for cast iron
TOOL-ARC for tool steel
WEAR-ARC for hard facing
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ALLOY RODS CO. York, Penna.

DoALL

INDUSTRY'S NEW SET OF TOOLS

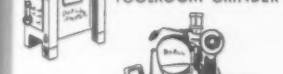

CONTOUR-MATIC


ZEPHYR


CONTOUR


BAND FILER


TOOLROOM GRINDER


CRUSH GRINDER


"COOL GRINDING" ATTACHMENT


BLADE WELDER

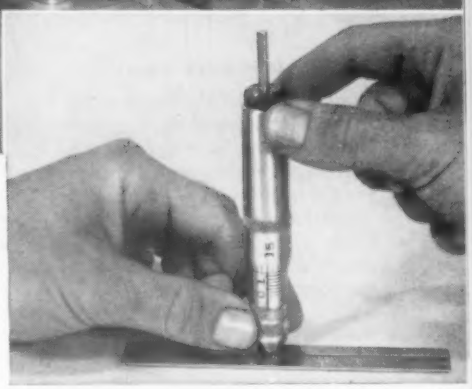

GAGE BLOCKS


GAGE ACCESSORIES


VARIABLE SPEED DRIVES

SAW BANDS

G. N. Krouse, owner of Krouse Testing Machine Co., Columbus, Ohio, inspecting 5" micrometer scales after "Cool Grinding" on DoALL Model G-1 Surface Grinder. These scales with .001" tapec from end to end are held to accuracy of .00002" (20 millionths of an inch). Their micrometers and scales are used to measure plating thickness.



DoALL COOL GRINDING

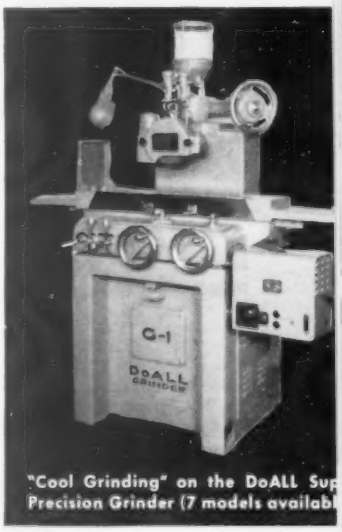
U.S. Patent No. 2470350

(Coolant-through-the-Wheel)

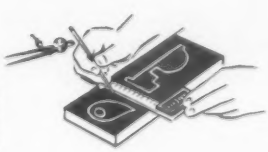
This patented technique used with a DoALL Surface Grinder opens an entirely new grinding era—faster, more accurate, better finishes.

1. Cooler grinding temperature.
2. Full visibility of work. No mess.
3. Longer wheel life—less "loading," less frequent dressing.
4. Finer finish—no cracking, warping or "skin softness".
5. No special wheels required, no power consuming pumps, no space taking tanks.

SEE HOW IT WORKS. Interesting because it's so revolutionary. Call your local DoALL Store today and ask for a demonstration.



"Cool Grinding" on the DoALL Sup
Precision Grinder (7 models availabl


TOOL STEEL


BENCH FILER

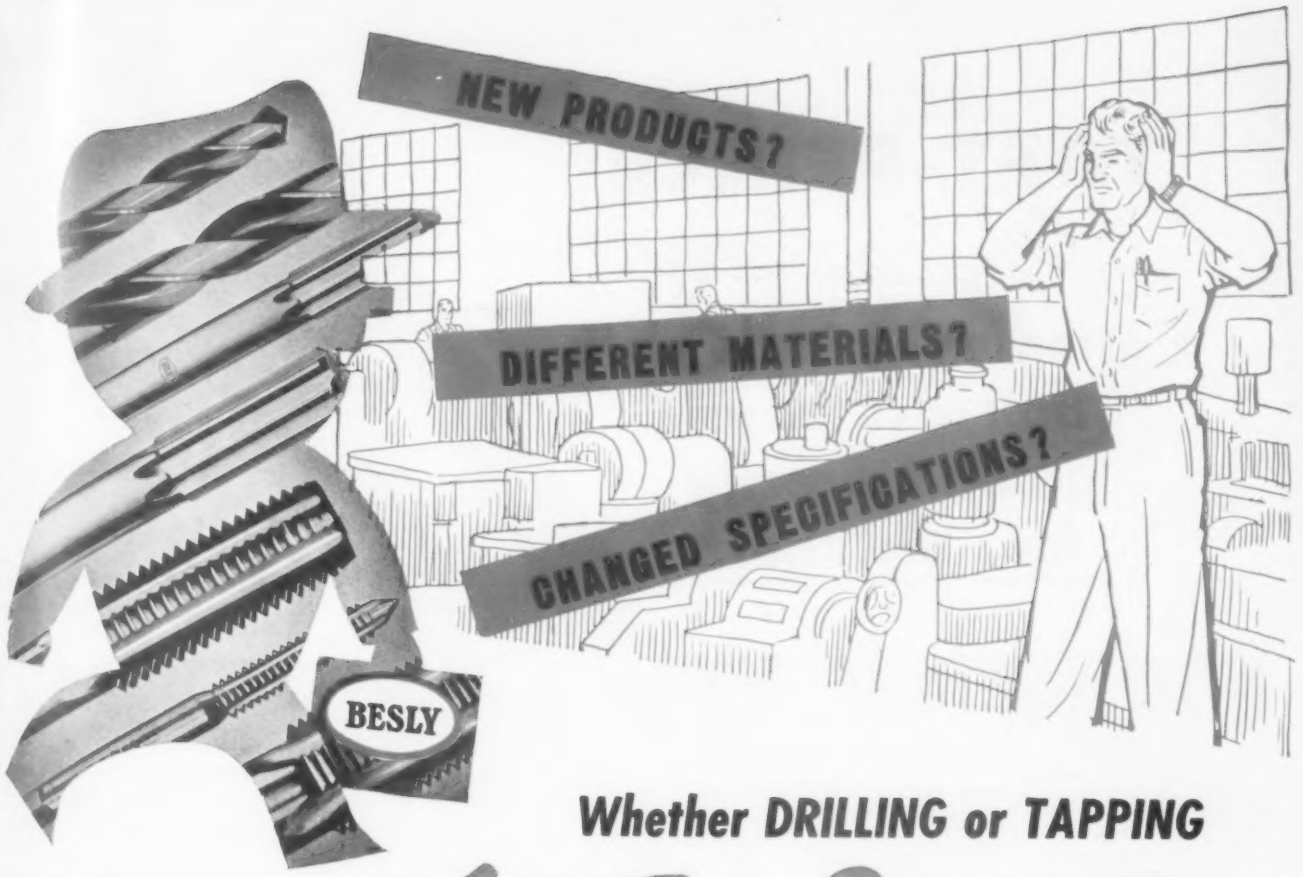
The DoALL Company

Des Plaines, Ill., U.S.A.

Cable Address: DoALL, Des Plaines

DoAll Stores In Key Cities

Factory Trained Representatives Everywhere



Whether DRILLING or TAPPING

Let BESLY Help You Solve Todays Problems Today!

UNSURPASSED ACCURACY
at *all* vital points

Microcentric CHAMFER
Micro finish, concentric to tenths of thousands. Cuts freely and to size without burring or welding.

Solid Ground THREAD FORM
For angle and lead accuracy, eliminates gauging problems and control of pitch diameter to tenths of thousandths.

"Right" ROCKWELL
Taps pre-inspected for correct Rockwell hardness.

Mirror Finish FLUTES
Correct design to provide freer chip flow and longer tap life.

Tru-Square DRIVER
Square and shank fit correctly in chucks and holders. No wobble to cause oversize holes.

Today's conditions demand many a re-check of tap and drill specifications—because most shops are coming up against new materials . . . using substitute materials . . . or tooling up for new and unfamiliar work.

Daily contact with these new tapping and drilling problems by Besly service men certainly can help you overcome new and difficult job conditions. Besly servicemen, today, are using their wide knowledge of drilling and tapping to extend tool life and work with production men to boost the number of holes per dollar invested. Their knowledge begins with tool design and carries through to on-the-job application of the *best* tap and drill for your work . . . whether standard or special.

For tap and drill engineering service that will help you get maximum tool life with peak performance at lowest cost per hole, call on *Besly*. Ask your Besly Distributor to call in the Besly Serviceman to work with you on your "problem" jobs.

FREE . . . BESLY TAPPING MANUAL
Contains latest data on tap selection and application, best tapping procedures. Write for your copy.

BESLY

TAPS — the world's most accurate tap.

TWIST DRILLS AND REAMERS —Complete line for every need.

TITAN ABRASIVE WHEELS AND DISCS—individually formulated for your job.

GRINDERS that reduce costs on every type of surface grinding.

CHARLES H. BESLY & COMPANY
122 N. Clinton Street • Chicago 6, Illinois
Factory: Beloit, Wisconsin

TAFT-PEIRCE *Introduces*

a grinding spindle with ball raceways ground directly into the shaft

Made of toughened steel, hardened and ground all over. Driven by ¾ H.P., 3600 r.p.m. motor. Quill 3" in dia.; nose taper 3", ft.; length over-all 22⅛". Entire unit sealed and lubricated for life.

★ Handles far heavier loads

★ Gives the ultimate in precision and finish

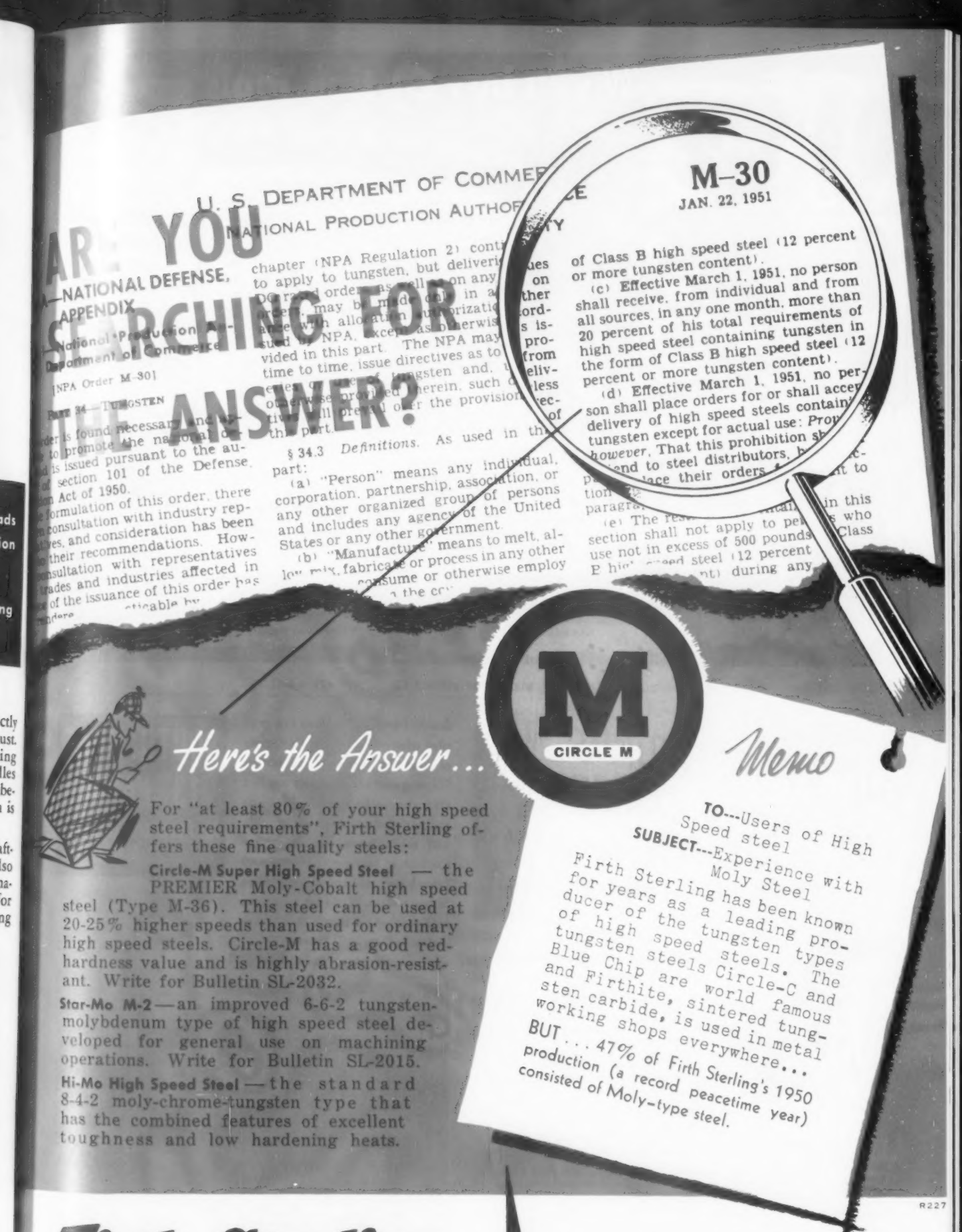
★ Ensures minimum chatter

★ Ensures concentricity of wheel mounting with axis of rotation

Ball raceways of this new spindle, ground directly into the shaft, carry both annular and axial thrust. Virtually eliminated is run-out of wheel mounting thimble, a fault frequently encountered in spindles with built-up bearing assemblies. Furthermore, because of this new feature, the spindle construction is far stronger and heavier.

Designed to provide maximum precision in Taft-Peirce Surface Grinders, this new spindle is also adaptable to wide use on other surface grinders, machine tools, and special applications. Write today for further information to the Taft-Peirce Manufacturing Company, Woonsocket, R. I.

T-P means TOP PRECISION



For "at least 80% of your high speed steel requirements", Firth Sterling offers these fine quality steels:

Circle-M Super High Speed Steel — the PREMIER Moly-Cobalt high speed steel (Type M-36). This steel can be used at 20-25% higher speeds than used for ordinary high speed steels. Circle-M has a good red-hardness value and is highly abrasion-resistant. Write for Bulletin SL-2032.

Star-Mo M-2 — an improved 6-6-2 tungsten-molybdenum type of high speed steel developed for general use on machining operations. Write for Bulletin SL-2015.

Hi-Mo High Speed Steel — the standard 8-4-2 moly-chrome-tungsten type that has the combined features of excellent toughness and low hardening heats.

R227

Firth Sterling

STEEL & CARBIDE CORPORATION

MILL: McKEESPORT, PA.

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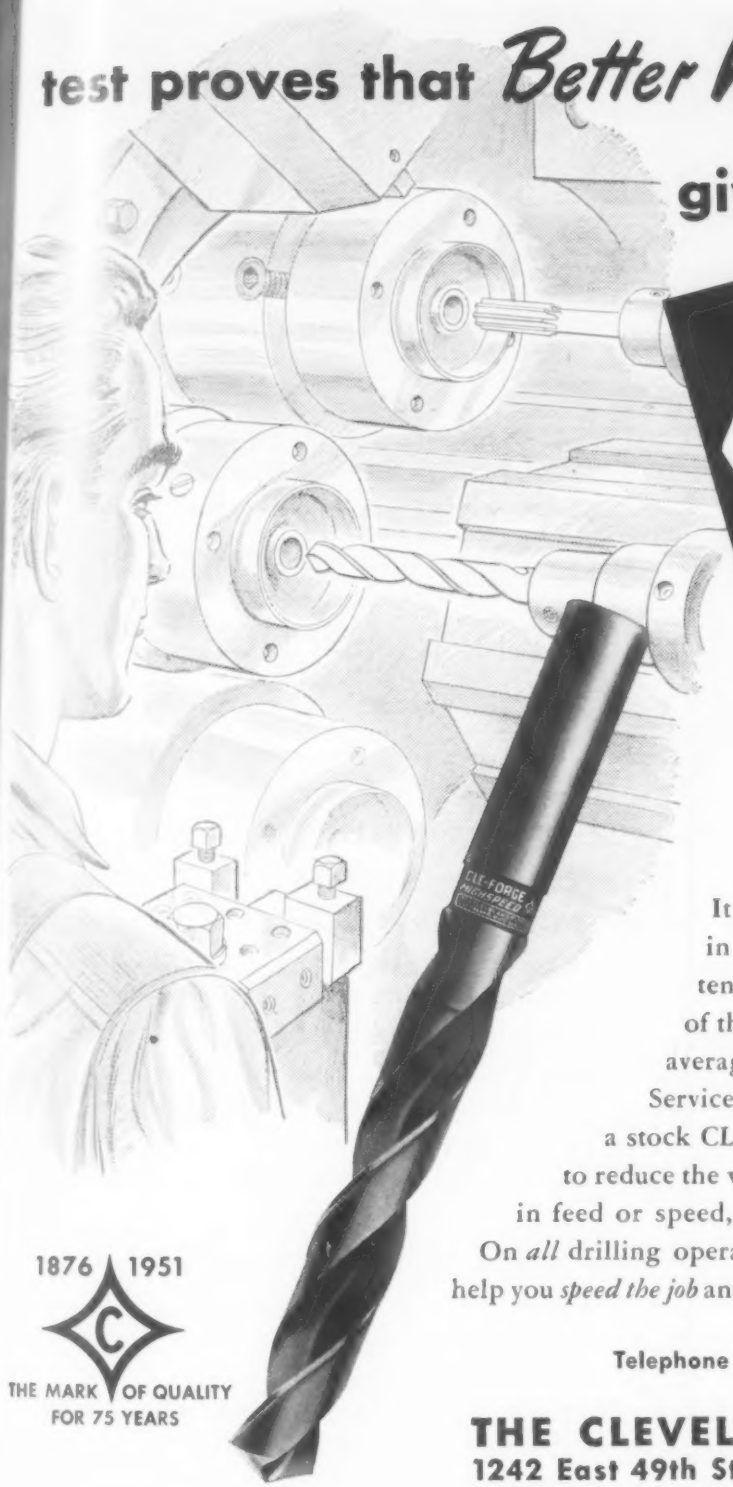
test proves that *Better Wearing Qualities* give you 42% MORE HOLES PER GRIND

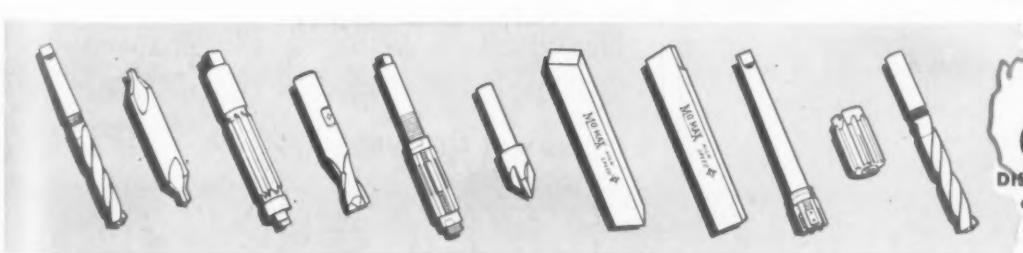


1876 1951
THE MARK OF QUALITY FOR 75 YEARS

It was a smooth-running job—drilling 1 9/32" holes in a cast iron cover, ½" thick—but the superintendent wasn't satisfied with the wearing qualities of the high speed drills that were being used. They averaged 2705 holes per grind. ◇ When a *Cleveland* Service Representative was called in, he recommended a stock CLE-FORGE High Speed Drill that is engineered to reduce the wear caused by abrasive action. With no change in feed or speed, this drill averaged *3862* holes per grind! ◇ On *all* drilling operations, a *Cleveland* Service Representative can help you *speed the job* and *cut costs.* Contact our nearest Stockroom, or . . .

Telephone Your Industrial Supply Distributor

THE CLEVELAND TWIST DRILL CO.
1242 East 49th Street Cleveland 14, Ohio
***Stockrooms:* New York 7 • Detroit 2 • Chicago 6 • Dallas 1 • San Francisco 5**
Los Angeles 58 • London W. 3, England



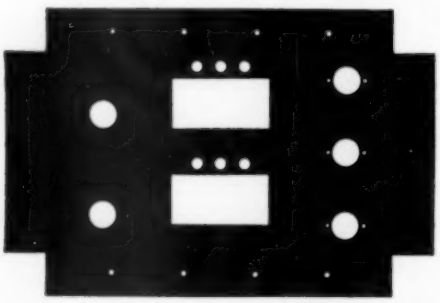
ASK YOUR INDUSTRIAL SUPPLY DISTRIBUTOR FOR THESE AND OTHER *Cleveland* TOOLS

STOP! the high cost of piercing sheet metal in quantities of 1-5-10-50-100 or 200 pieces of a kind.

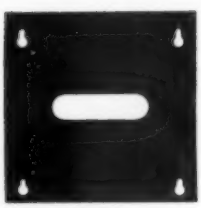
COMPARE! the Wiedemann R-41P with your best times on jobs similar to those below on sheets up to 26" x 48".

TIMES! shown include set-up.

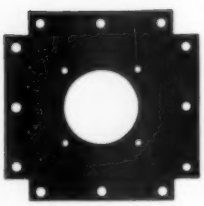
INVESTIGATE the WIEDEMANN METHOD



First piece 9.5 minutes
Additional pieces
2.75 minutes each
Includes all set up



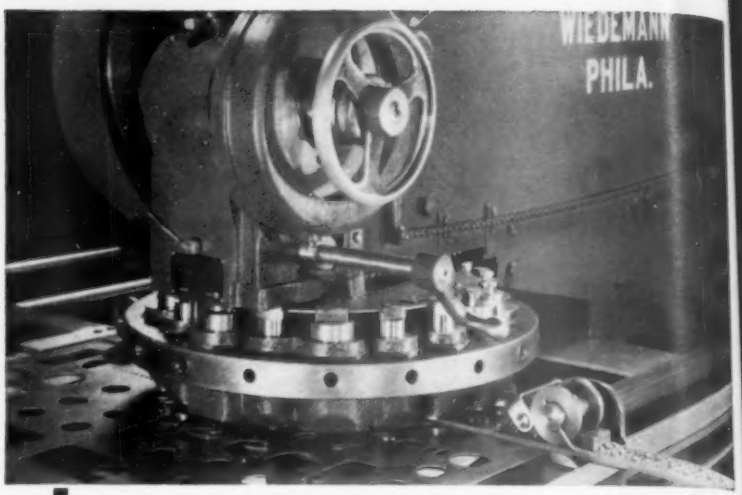
First piece 3.75 minutes
Additional pieces
.90 minutes each
Includes all set up



First piece 2.40 minutes
Additional pieces
1.05 minutes each
Includes all set up

Do You Produce Templates?

The Wiedemann R-43 Micro-Turret Punch Press produces templates with holes accurate to ± .002" at unparalleled high speed. Write for details.



R-41P Wiedemann Turret Punch Press

Here's how you can pierce short run work at such great savings

SAVE on Tool Set-up

- ★ 18 punches and dies set-up for instant use
- ★ Install tools in turrets in less than one minute
- ★ Tool cost is always low

SAVE with UNMATCHED FLEXIBILITY and SPEED in ACCURATELY LOCATING HOLES

- ★ Gauges are set-up from drawing dimensions, charts, or templates
- ★ Gauges locate from one corner of the material
- ★ Center punched layout or pilot holes
- ★ Back gauge bar is handwheel operated
- ★ Cross stops are positive
- ★ Both motions are provided with direct reading scales or dials

THE R-41P TURRET PRESS PIERCES . . .

- ★ Round holes to 3⅛" dia.; square holes to 2¼" x 2¼"; round end slots to 3⅛" long.
- ★ Odd shaped and grouped holes
- ★ Knockouts, dimpling, corner and edge notches, radius corners, small louvres
- ★ Special corner development cutouts
- ★ Large rectangular, square, or L shaped openings

THE WIEDEMANN METHOD IS THE ONLY LOGICAL SOLUTION TO THE SHORT RUN PIERCING PROBLEM

Send Drawings for Time Study

WIEDEMANN MACHINE COMPANY

4245 Wissahickon Avenue • Philadelphia 32, Pennsylvania

STANDARDIZE WITH THE NEW BETTER THAN "STANDARD"

SINTERED
FIRTHITE
CARBIDE

HA **TA** **T-04**

These *new, improved Firthite standard* grades are superior in many respects to the more costly "special" grades formerly required. Better performance goes hand-in-hand with carbide tool standardization.

By specifying these *new, improved* grades of Firthite you get *faster service* because we can concentrate our production and furnish larger quantities to industry.

With Fithite's *improved standard* grades, there will be less need for large stocks of "special" grades. Excessive investments in "special" tool or tip stocks can be eliminated.

The tremendous demand for carbide tips and tools, plus controlled supplies of critical alloys, requires grade standardization wherever possible to maintain your production schedules at peak efficiency.

Nearly three years of research* and shop testing have proved the superiority of the new, improved *Firthite* standard grades HA, TA and T-04 over the other standard and special grades of sintered carbide. We know they are outstanding . . . let us prove it to you.

ASK FOR A FIRTHITE SERVICE ENGINEER TO HELP YOU STANDARDIZE WITH THE NEW IMPROVED HA, TA, T-04 GRADES.

R204

Research is important and continuous at Firth Sterling on all carbides and tool steels.

Firth Sterling STEEL & CARBIDE CORPORATION
McKEESPORT, PA.

DISTRICT OFFICES AND WAREHOUSES

HARTFORD NEW YORK PHILADELPHIA DETROIT CLEVELAND
DAYTON PITTSBURGH CHICAGO BIRMINGHAM LOS ANGELES

TAKE A LESSON FROM THE BIG USERS... TRIPLE PRODUCTION WITH ROBERTSON WHEELS

Cost-conscious and production-wise manufacturers the country over have been quick to take advantage of Robertson Wheels . . . to benefit from the longer wheel life, increased production and lower power consumption they make possible.

The following experience of a motor shaft manufacturer is typical of many users of Robertson Wheels.

Using a conventional wheel on his Landis Cylindrical Grinder to remove .015″ to .020″ stock from SAE 1040 steel, and held to a tolerance of plus .001″ minus .000″; he was able to finish only 10 pieces per wheel dressing. Wheels were being worn out excessively fast by too many dressing and truing operations; and production was slowed by the resulting work stoppages.

A Robertson Engineer, called in for advice, recommended substituting an 18″ x 2″ x 5″ RA 462-MV Robertson Wheel. With no other change in grinding method, *production immediately jumped to 30 shafts per wheel dressing* . . . a threefold increase in production, and longer wheel-life to boot!

The manufacturer, of course, was delighted—as so many are, once they find how Robertson Vitrified and Resin-Bonded Grinding Wheels take the tough jobs in their stride. For proof, *blueprint* your grinding problem and let us recommend a wheel for the job. Then compare the results you get from a Robertson with those of a conventional wheel.

Today, some of the country's largest manufacturers are using Robertson Wheels and Robertson engineering services. Their names will be sent on request.

ROBERTSON MANUFACTURING COMPANY

TRENTON 5, NEW JERSEY

Resin-Bonded and Vitrified-Bonded Grinding Wheels • Mounted Wheels • Segments

Standard Delta Bench Lathe used by Allen Bradley Co., Milwaukee, to wind electrical coils at low cost. Coils wound between two plates on mandrel held in 3-jaw chuck, supported by tail center.

Two standard Delta Abrasive-Belt Finishing Machines mounted on one stand provide low-cost tube polishing set-up. Two motors are used — one speed for drive and feed action, one for actual grinding.

Battery of standard Delta 10" tilting-arbor Unisaws used by Consolidated Vultee Air-Craft Corp., San Diego, California to cut aluminum alloy in a wide variety of thin sheets and shapes.

DELTA
MILWAUKEE
®

From the world's most complete line
First in selection!
First in quality!
First in value!

Designed for wood but "Doubling in Brass"

For many of your non-ferrous metal operations Delta woodworking machines offer quick, low-cost solutions

Don't let habit limit your planning when machines are scarce, time is short, and costs run high! Remember that *standard Delta woodworking machines are often the quickest, best, low-cost solution* for non-ferrous metal cutting, machining, and fabricating. Our files are full of other convincing reports like those shown above. Send for complete details — and plan your jobs around the versatility of dependable Delta tools — high in quality, low in cost! Call on Delta's engineering service help.

Sold only through authorized dealers — available on easy time payments. Look for the name of your Delta dealer under "Tools" in the classified section of your telephone directory.

DELTA POWER TOOL DIVISION
Rockwell
Manufacturing Company
MILWAUKEE 1, WISCONSIN
DELTA • MULTIPLEX • CRESCENT • HOMECRAFT

Delta 10" Tilting Arbor Unisaw

Big table, big cuts — rips stock (wood) 3⅛" thick, cuts to center of 50" panel. Table size 20" x 27" (27" x 36" with wings). Blade tilts 45° to right. Lubricated-for-life ball-bearings in diamond-bored seats. Other Delta circular saws: 8" Tilting Arbor, and Tilting Table . . . 10" Tilting Table, 12" Tilting-Arbor . . . and 8" to 20" Radial-Arm types. At prices from $69.95 to $930.00.

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The Power Tool Journal — packed with detailed job data, fully illustrated — handbook of time- and money-saving shop ideas!

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M-53

HERE'S HELP FOR YOUR CARBIDE TOOLMAKER

. . . his big problem today is getting the best carbide to do your job!

. . . BEST *for performance*
. . . BEST *for availability*
. . . BEST *for price*

● Think twice when indicating your carbide grade specification . . . don't limit your carbide toolmaker to a brand or grade of carbide which is unavailable or not *best* suited for your job.

Independent carbide toolmakers have found through years of experience that ADAMAS enables them to turn out better tools on a faster delivery schedule. The availability of a complete line of standard and special tips in *work-proved* grades has made them eager to use ADAMAS tungsten carbide.

Specify an ADAMAS grade on your next job and have the advantages of ADAMAS *quality, delivery and price.*

YOU CAN HELP YOUR CARBIDE TOOLMAKER BY SPECIFYING

ADAMAS

The revised ADAMAS "Carbide Manufacturers' Grade Recommendations" showing grade recommendations of all carbide manufacturers will help you in selecting the proper tungsten carbide for your job. Write for your FREE copy.

ADAMAS
CARBIDE CORPORATION
Harrison, New Jersey

Producers of top quality carbide for cutting tools, dies and wear resistance.

ADAMAS CARBIDE CORPORATION
Dept. G, Harrison, New Jersey

Please send me FREE your "Carbide Manufacturers' Grade Recommendations."

Name . . . . . .
Company . . . . . .
Address . . . . . .
City . . . . . Zone . . . . State . . . . .

Gear Tooth Crowning

(ELLIPTOID TOOTH FORM)

A CONTROLLED PRECISION MACHINING OPERATION

Gear tooth crowning (Elliptoid Tooth Form) is used for just one purpose—to prevent "end bearing," which is a concentration of operating load at the end of the tooth where it is most vulnerable to failure.

Crowning is the only way to prevent end bearing because with any gear assembly it is impossible to maintain accurate gear alignment under all conditions of loading. Shafts, bearings and mountings are all elastic. Even the slightest deflection will cause misalignment and end bearing in gears with conventional teeth.

Many of the leading automotive gear plants have standardized on crowning to raise the factor of safety of gear teeth and to reduce operating gear noise. Crowning does both successfully.

Crowning accomplished on Red Ring Gear Shaving Machines is a precision machining operation by which the maximum amount of crown is always under positive control. Tolerance control is indicated by a typical routine check of a lot of 4000 gears having the following specifications: 1″ face, 18 teeth, 13.5 Nor D.P., 20° Nor P.A., 27° H.A. and .0003″ to .0005″ crown. An adequate check failed to reveal any unit outside the .0002″ tolerance on crowning.

WRITE FOR BULLETIN S49-5 FOR A MORE DETAILED DISCUSSION OF GEAR TOOTH CROWNING

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORM

5621

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN . . . . . DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

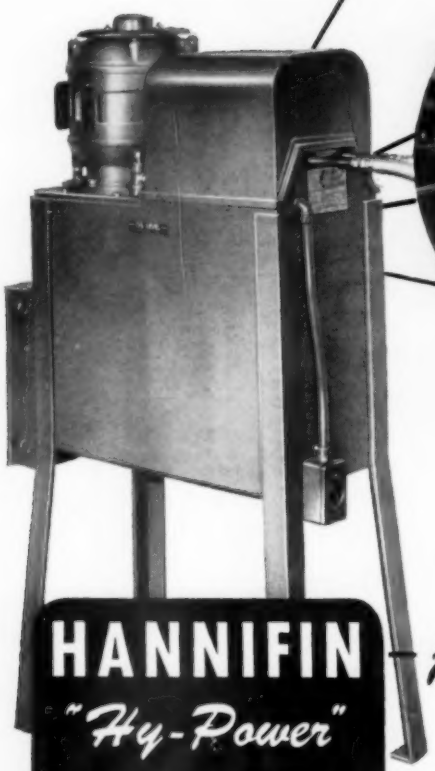
With these Tools One Man Can Do More Work!

PUNCHING—7½-ton Hannifin "Hy-Power" Portable Punch used in the assembly of light gauge sheet metal structures.

RIVETING—Fabricating steel furnace sections with 25-ton Hannifin "Hy-Power" Portable Hydraulic Riveter.

RIVETING—35-Ton "Hy-Power" Portable Riveter used in assembling heavy truck trailer frames.

PRESSING—7½-Ton Portable "Hy-Power" Press used in pressing timing gears on automobile engine crankshafts on conveyor assembly lines.

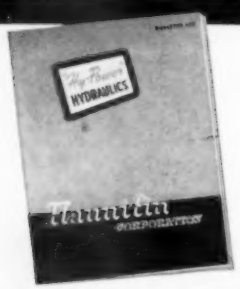


HANNIFIN "Hy-Power" HYDRAULIC Power Units

plus TOOLS that anyone can operate!

HERE is a combination that can't be beat! Hannifin "Hy-Power" hydraulic units quickly pay for themselves in even small production shops. In any plant, they enable a man to handle almost unbelievably large volumes of work with a minimum outlay for equipment and floor space. A most important advantage is that anyone can operate them and, without any special skill or experience, turn out perfect work hour after hour at peak speed. Physical effort needed to handle balanced tools is negligible. Work performed by different operators is always uniform.

Hannifin supplies everything you need—complete units designed to meet your particular requirements, or power units and cylinders for use in machines of your own design. Today, in thousands of installations throughout the world, production engineers and tool designers are using Hannifin "Hy-Power" Hydraulic equipment as the key to better, faster production and lower costs for an almost unlimited range of applications! You, too, can benefit from this equipment. *For complete information, see your local Hannifin representative, or write.*



"Hy-Power Hydraulics"—ASK for a copy of this 28 page illustrated Bulletin No. 150 for Tool Designers and Production Engineers.

HANNIFIN CORPORATION

1119 South Kilbourn Avenue • Chicago 24, Illinois

AIR CYLINDERS • HYDRAULIC CYLINDERS • HYDRAULIC PRESSES
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Automatic Recessing

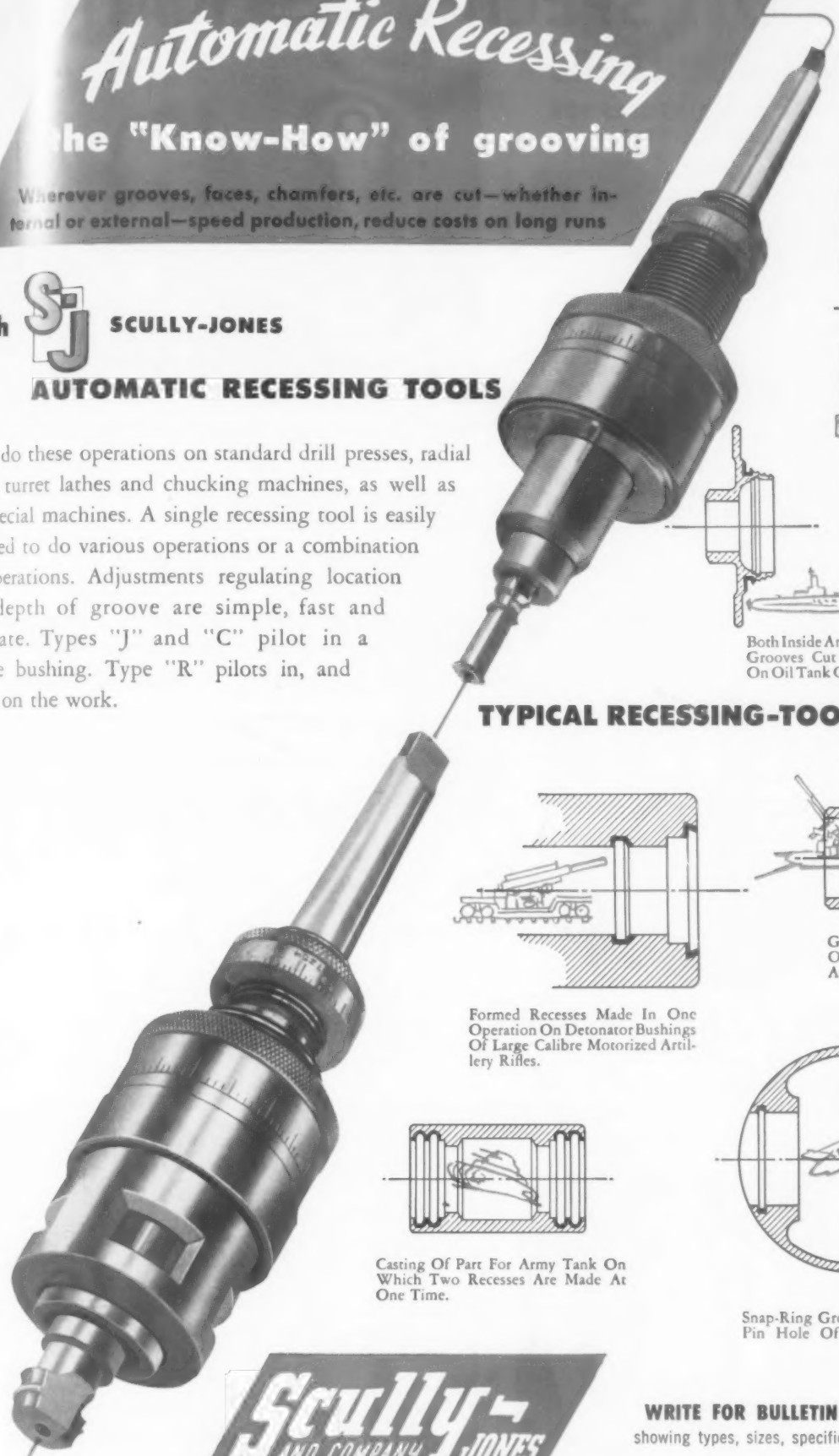
the "Know-How" of grooving

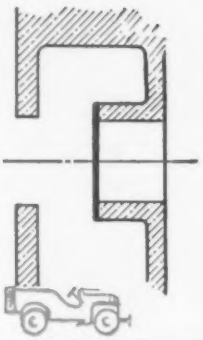
Wherever grooves, faces, chamfers, etc. are cut—whether internal or external—speed production, reduce costs on long runs

with S-J SCULLY-JONES

AUTOMATIC RECESSING TOOLS

They do these operations on standard drill presses, radial drills, turret lathes and chucking machines, as well as on special machines. A single recessing tool is easily adapted to do various operations or a combination of operations. Adjustments regulating location and depth of groove are simple, fast and accurate. Types "J" and "C" pilot in a fixture bushing. Type "R" pilots in, and stops on the work.



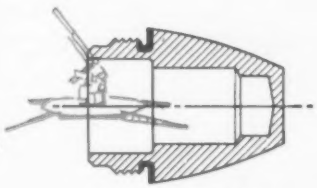


Facing An Internal Boss On Motor Castings Where Obstruction Usually Causes Difficulty.

Both Inside And Outside Clearance Grooves Cut In One Operation On Oil Tank Caps For Submarines.

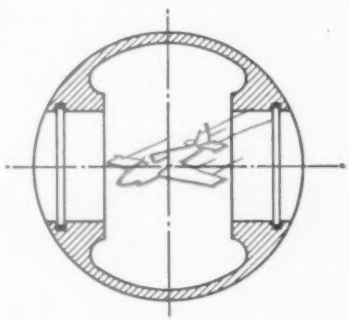
TYPICAL RECESSING-TOOL OPERATIONS

Formed Recesses Made In One Operation On Detonator Bushings Of Large Calibre Motorized Artillery Rifles.



Groove For Thread Clearance Cut On Anti-Aircraft Projectile With Automatic "Necking" Tool.

Casting Of Part For Army Tank On Which Two Recesses Are Made At One Time.



Snap-Ring Grooves Cut In Wrist Pin Hole Of Airplane Pistons.

Scully-Jones AND COMPANY

1915 S. ROCKWELL ST., CHICAGO 8, ILLINOIS

WRITE FOR BULLETIN No. 10-50
showing types, sizes, specifications and prices.

R 5496

YOU GET LOW COST, FAST, ACCURATE PRODUCTION WITH OUR STANDARD AND SPECIAL TOOLS

ILLINOIS TOOL WORKS
WILL DESIGN AND BUILD YOUR

COMPLETE RIFLING TOOLING!

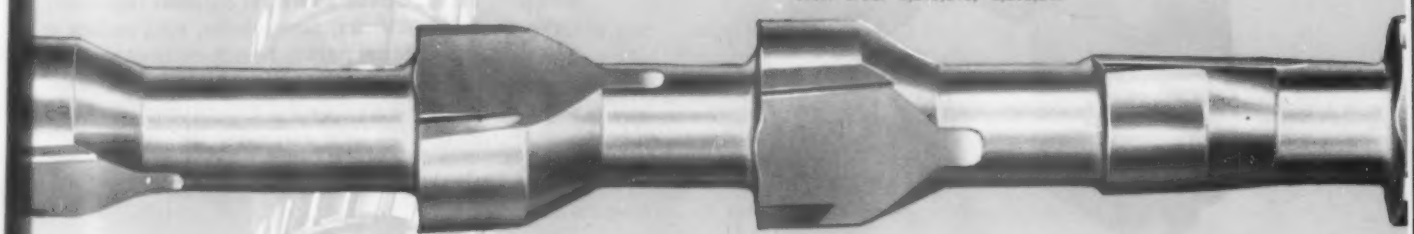
Take advantage of the same engineering skill and experience that *originated* modern rifle broaching technique!

Bring your *specific* gun barrel rifling problems to Illinois Tool Works. Experts, backed by more than 12 years of development work and a complete line of broaching tools and equipment for rifling, are at your service. See how Illinois Broaches will give you better finishes in less time... learn how Illinois Tool Works checking machines will help you attain longer tool life. Call Illinois Tool Works today.

WAFER TYPE RIFLING CUTTERS for gun barrels up to 8 inches . . . in complete sets designed for economical sharpening and progressive replacement.

RIFLING BROACHES for .30 caliber to 20 mm. gun barrels . . . generate their own lead . . . designed for longer life and easier sharpening.

PAT. NOS. 2,210,848, 2,210,849

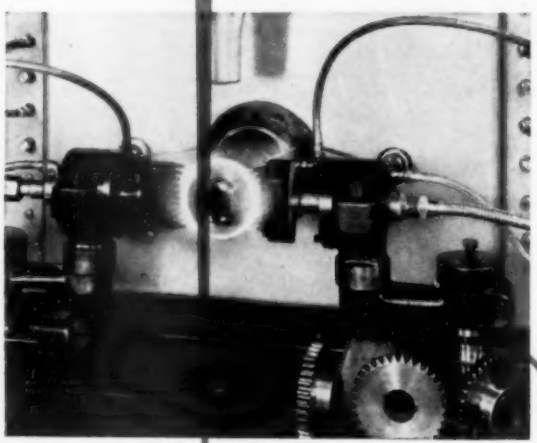


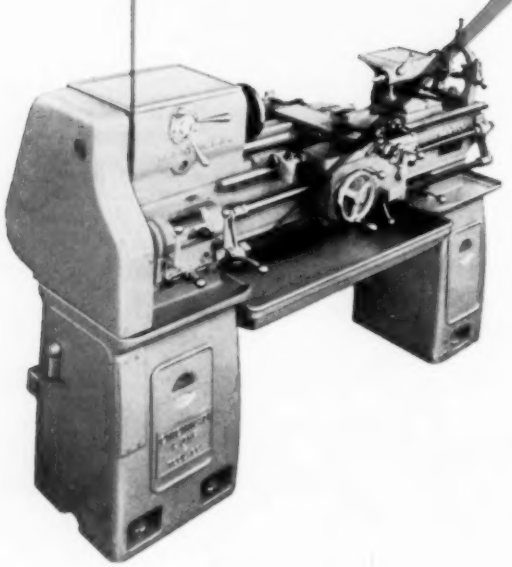
ILLINOIS TOOL WORKS

2501 North Keeler Avenue, Chicago 39, Illinois
In Canada: Canada Illinois Tools Ltd., Toronto, Ontario

"Headquarters for Engineered Cutting Tools"

flame facts





Flame hardened gears throughout are standard... **flame hardened bed ways** are available at small extra cost . . . in Tray-Top light duty all geared head engine and toolroom lathes. Add these plus values to **versatility:** 12 spindle speeds, 48 thread and feed changes, top speeds to 1800 rpm., quickest changeover from English to metric thread chasing . . . **operator convenience:** centralized controls, instant speed selection with direct reading color-match speed selector, dual control levers, "Tray-Tops" on headstock and tailstock for parking tools, mikes, gages, etc. . . . **operator safety:** totally enclosed change gear box, totally enclosed electrical panel, accessible only by opening master disconnect switch, feed levers disengaged in down position . . . **floor space savings:** cabinet legs really have room for chucks, face plates, etc., reduce or eliminate need for separate bench or storage space . . . Add up all Tray-Top's outstanding values and you'll find it your best buy. Swing sizes: 10", 12½", 15", 18". Write for new bulletin.

CINTILATHE

OF OUTSTANDING VALUE

CINCINNATI 9, OHIO, U.S.A. cincinnati lathe & tool co.

Doing a bigger job...better

The advantages of V 20 bond wheels are best realized on production jobs where they provide extra efficiency and economy in fast, accurate tool grinding. Stock removal rate is high at reduced wheel pressures. With a minimum of heat generation and excellent form holding qualities—long lasting V 20 bond wheels impart a uniform fine finish that extends tool life between grinds. The effective use of fewer grades, (smaller inventories) to do a variety of jobs is another advantage often realized.

Only CARBORUNDUM
TRADE MARK

makes ALL Abrasive Products ...to give you the proper ONE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, N.Y.

"BEST BY ANY TURNING TEST"
in the toolroom and on the production line.
Write to Dept. 710 for complete information
and performance data.

Jones & Lamson turret lathes are BUILT and POWERED TO PRODUCE

MORE CHIPS per tool
MORE PIECES per hour
MORE PROFIT per job . . . than any turret lathe of comparable size!

Turret Lathe Division **JONES & LAMSON** MACHINE COMPANY
Springfield, Vermont, U.S.A.
MACHINE TOOL CRAFTSMEN SINCE 1835

PARKER • MAJESTIC pm PRECISION MACHINES

Above is pictured the home and products of the

PARKER-MAJESTIC, INC.

For over twenty-one years this company has manufactured the Parker Spindles used in Precision Grinding, Boring and Milling applications.

Supplementary products include the well known line of Parker-Majestic Internal, External, No. 2 Surface and Rotary Surface Grinders.

Descriptive literature upon request.

PARKER-MAJESTIC, INC.

formerly **MAJESTIC TOOL & MFG. CO.**

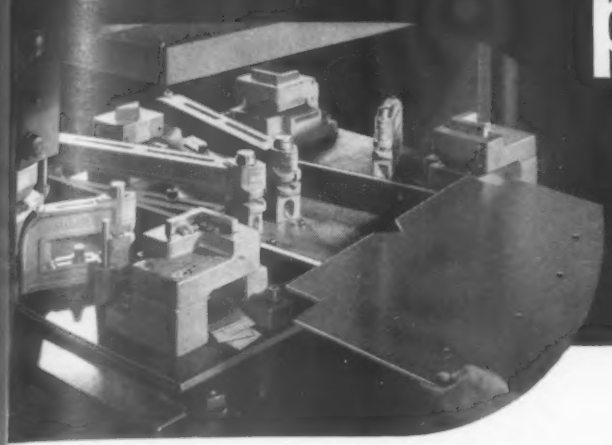
147 JOS. CAMPAU • DETROIT 7, MICHIGAN

Index of The Tool Engineer Advertisers

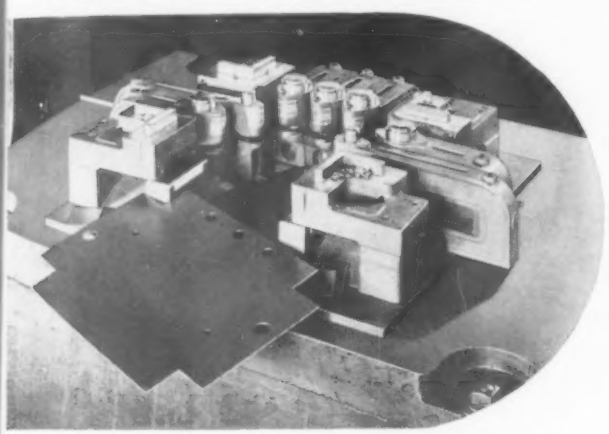
APRIL, 1951

The Index to Advertisers is published as a reader service. Although every precaution is taken to assure correct listing, no allowance will be made for error or omission.

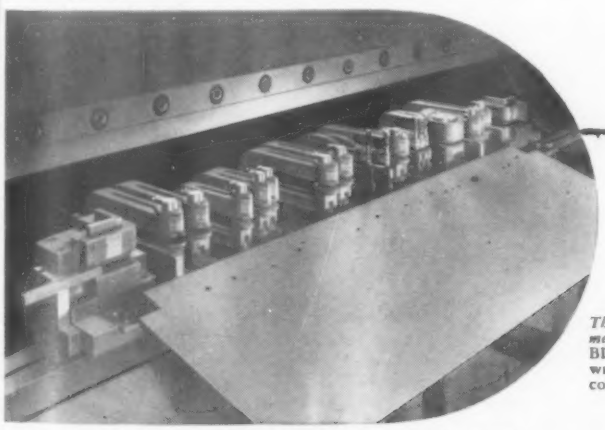
How WALES UNITS punch and notch simpler and quicker



A template set-up of Wales Type "BL" Hole Punching Units and Type "N" Notching Units in a stamping press for punching and notching in the same operation as shown in the work in foreground.



Another typical set-up of Wales Hole Punching and Notching Units mounted on the template outside the press and slid onto the press bed ready to operate with the first stroke of the press ram.



Illustrating a combination set-up of Wales Notching and Hole Punching Units on a press brake set-up. Note that straight line or staggered hole patterns may be punched with Wales Hole Punching Units.

● Setting up Wales Units is a simple assembly operation outside the stamping press or press brake. This fast, time-saving feature permits set-ups to be moved onto the press bed and start production with the first down stroke of the press ram.

With punch and die held in perfect alignment by a holder, this independent, self-contained design eliminates the usual time consuming, *individual* adjustments required to align conventional dies. Nothing is attached to the press ram.

Each Wales Unit is independently mounted which provides quick set-ups for various hole punching patterns. Such set-up flexibility keeps this tooling investment in practically continuous productive operation.

A GOOD RULE — Check with Wales-Strippit before punching or notching angles, channels, extrusions or sheets by any method.

WALES-STRIPPIT CORPORATION
GEORGE F. WALES, *Chairman*
393 **PAYNE AVE., NORTH TONAWANDA, N. Y.**
(Between Buffalo and Niagara Falls)
WALES-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO
Specialists in Punching and Notching Equipment

The multiple savings in time and investment with Wales Equipment is too BIG a story to tell in this space, so write for fully-illustrated, functional-colored Catalog BL and Catalog N.

Write for these 2 Catalogs TODAY!

PICK THE BUSHING TO FIT THE JOB . . .

Order from EX-CELL-O's Stock!

Several types of Ex-Cell-O Drill Jig Bushings and liners are used in the box type jig pictured above. The Ex-Cell-O Bushing Catalog will help you select the right bushings for your jobs, and you can be sure of prompt shipment of standard bushings from stock.

Standard bushings with special hole sizes are stocked in Detroit in semi-finished form, and can be finished quickly to the exact size you require. You'll find that the uniform accuracy, finish and hardness of Ex-Cell-O Bushings prolong the life of both the bushings and the tools used with them.

FAST SHIPMENT FROM STOCK IN FOUR CITIES: In addition to a stock of over 6-quarters of a million bushings being renewed constantly in Detroit, standard bushings also are stocked for immediate shipment at Ex-Cell-O Corporation, 53 Park Place, New York; Machinery Sales Co., 2838 Leonis Blvd., Los Angeles, Calif., and Williams & Wilson, Ltd., 11 Front St. E., Toronto, Ontario, Canada.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS • RAILROAD RODS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • PAINT EQUIPMENT

XLO
EX-CELL-O for PRECISION

Let This Catalog Help You . . .

This Ex-Cell-O catalog, Bulletin 35371, will help you pick the right bushing to fit the job. A copy will be sent to you on request without obligation.

Typical Dimensions and Relationships measured with *Sheffield*

PRECISIONAIRE GAGES

The ranges of dimensions and position relationships which can be measured quickly and precisely by Precisionaire Gages is almost limitless. In fact, some such measurements are possible otherwise only by elaborate auxiliary equipment in a well equipped laboratory to obtain the same degree of accuracy. Illustrated here are typical Precisionaire applications in which deviations have been exaggerated for greater clarity.

Precisionaires are the only gages which offer the combined advantages of greater linear scale length, amplifications of less than 1,000 up to more than 100,000 to 1, and instantaneous accurate reading regardless of the distance between the gaging element and the base instrument.

"If it can be gaged by air, it can be gaged best by Precisionaire."

Write for Precisionaire Application Book— or call your Sheffield Representative.

the *Sheffield* corporation

Dayton 1, Ohio, U.S.A.

MASTER CRAFTSMEN SHEFFIELD HEADQUARTERS

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